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Motive Power Department:

Nickel Plate Installs 15 2-8-4 Type Fast-Freight Locomotives 387
Boxpok Locomotive Driving-Wheel Center..... 391
Underframes for D. L. & W. Diesel-Electric Locomotives 393
McLain Locomotive Cylinder Cock..... 399

Car Department:

Designing Welded Passenger-Train Cars..... 395
Davis Heavy-Service Steel Wheel..... 399
National F-2-A Car Truck Stabilizer..... 400
New Adaptation of Simplex Clasp Brake..... 400

General:

An Intimate Chat with a Division Superintendent. 392

Editorials:

Sectional Scales for Weighing Locomotives..... 402
Reporting Locomotive Defects..... 402
Smoke Prevention..... 403
Mechanical Conventions—Two Good Reasons For. 403
Moderation in Standardization..... 404
New Books..... 404

The Reader's Page:

Sectional Scales for Weighing Locomotives..... 405
A Desirable Characteristic of the Unaflow..... 405
Adaptability Counts 406

Car Foremen and Inspectors:

Lubrication of Railroad Car Journals..... 407
Pneumatic Clamp for Car Tenoning Machine..... 410
Shaping Sill Steps..... 410
Three Safety Devices at C. & N. W. Car Shops.. 411
Metal Covered Plywood..... 412
Arbitration Decisions..... 412

Back Shop and Enginehouse:

Building-Up Worn Main-Rod Front Ends..... 413
Combination Angle-Plate Grinder..... 413
No. 2 High-Speed Turret Lathe..... 414
Forging Main-Rod Back Ends..... 414
Making Boiler Front Rings and Doors..... 417
Removing Babbitt from Driving Wheels..... 417
Metal Coating To Prevent Corrosion..... 417
Torch Guide for Cutting Wheel Rims..... 418

Clubs and Associations 419

News..... 420

Index to Advertisers.....(Adv. Sec.) 15

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LIMA LOCOMOTIVE WORKS INCORPORATED

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Railway
Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal

November - 1934

Nickel Plate Installs 15 2-8-4 Type Fast-Freight Locomotives

Another road adopts this modern type for accelerating its freight movements

THE New York, Chicago & St. Louis is now receiving delivery of the first of 15 fast freight locomotives of the 2-8-4 type built by the American Locomotive Company. These engines, which are the first of this type to be placed in service by the Nickel Plate, are typical modern freight locomotives of what in the last few years has come to be recognized as good current practice. While of conventional design in so far as general appearance is concerned, they embody those details of design and proportions which are essential for the economical and expeditious handling of freight traffic in a relatively level territory.

The boiler is of generous capacity as it is now generally recognized that high sustained horsepower at speeds is dependent almost entirely on boiler capacity. The size of the cylinders, 25 in. by 34 in. with 69-in. drivers, is different from any previous locomotives of the 2-8-4 type. The rated tractive force with the 245 lb. boiler pressure is 64,100 lb.

As many detail parts of these new engines as possible are interchangeable with similar parts of the Chesapeake & Ohio 2-10-4 type locomotives. It will be recalled that 40 locomotives of this type were built for the C. & O. in 1930 by the Lima Locomotive Works, Inc., and that a full description was given in the *Railway Mechanical Engineer*, November, 1930.

The 2-8-4 type was first introduced in 1925, and for new power has taken the place of the long popular 2-8-2 type just as some thirty years ago the Mikado type superseded the 2-8-0 or Consolidation type for freight traffic other than slow drag freight. Each step forward has been marked by larger wheels for increased running speeds and larger boilers required for sustained horsepower at high speeds as well as improvements for increased efficiency.

Including the Nickel Plate there are now 298 locomotives of this type on nine roads. This includes the following: 55 on the Boston & Albany[1], built by the Lima Locomotive Works in 1925, which weigh 389,000 lb., have 28-in. by 30-in. cylinders, 63-in. drivers, 240 lb. boiler pressure, rated tractive force 69,400 lb. and 3,726 potential boiler horsepower; 50 on the Illinois Central[2], built by the Lima Locomotive Works in 1926, which weigh 388,000 lb., have 28-in. by 30-in. cylinders, 63-in. drivers, 240 lb. boiler pressure, rated tractive force 69,400 lb., and 3,966 potential horsepower; 12 on the Chicago & North Western[3], built by the American Locomotive Company in 1927, which weigh 397,000 lb.,

Front end of Nickel Plate 2-8-4 type locomotive

[1] *Railway Mechanical Engineer*, May, 1925, page 266.
[2] Railway Age, December 11, 1926, page 1161.
[3] *Railway Mechanical Engineer*, December, 1927, page 781.

Elevation and cross sections of the 2-8-4 type locomotive built by the American Locomotive Company for the Nickel Plate

have 28-in. by 30-in. cylinders, 63-in. drivers, 240 lb. boiler pressure, rated tractive force 67,200 lb., and 3,617 potential horsepower; 105 on the Erie[4], including four lots built in 1927, 1928 and 1929 by the American Locomotive Company, the Lima Locomotive Works and the Baldwin Locomotive Works, which weigh from 443,000 to 461,470 lb., have 28½-in. by 32-in. cylinders, 70-in. drivers, 225 to 250 lb. boiler pressure, rated tractive force 70,000 to 72,000 lb., and from 4,206 to 4,309 potential horsepower; 25 on the Boston & Maine[5], built in 1928 and 1929, by the Lima Locomotive Works, which weigh 393,000 lb., have 28-in. by 30-in. cylinders, 63-in. drivers, 694,000 lb., and 3,923 potential horsepower; 2 on the Toronto, Hamilton & Buffalo, built in 1928 by the Montreal Locomotive Works, which weigh 383,000 lb., have 28-in. by 30-in. cylinders, 63-in. drivers, 240 lb. boiler pressure, 69,000 lb. rated tractive force and 3,712 potential horsepower; 30 on the Missouri Pacific, built in 1928 and 1930 by the American Locomotive Company and the Lima Locomotive Works, which weigh 404,000 to 412,200 lb., have 28-in. by 30-in. cylinders, 63-in. drivers, 240 lb. boiler pressure, 69,400 to 70,500 lb. rated tractive force, and 3,828 to 3,944 potential horsepower. In all cases the tractive force given is that of the main cylinder. In most cases this is supplemented by a booster.

Boiler of Generous Proportions

Special attention was given to the boiler design with a view of providing ample steam generating capacity at all times and for all services. It is of conical design, 86 in. inside diameter of the first course on which is mounted the steam dome and increased to 98 in. outside diameter in the third course over the combustion chamber. The total length of the boiler, including the smokebox, is 44 ft. 8 7/16 in.

The firebox is 135 1/16 in. long by 96¼ in. wide, with a combustion chamber 42 in. long. Outside measurements at the mud-ring are 149 1/16 in. long by 109¼ in. wide. The firebox contains two thermic syphons and two arch tubes. The depth of the firebox from the top of the grate to the center of the lowest tube is 27⅝ in. and the height from the bottom of the mud ring to the crown sheet is 68 in. at the back and 92¾ in. at the front.

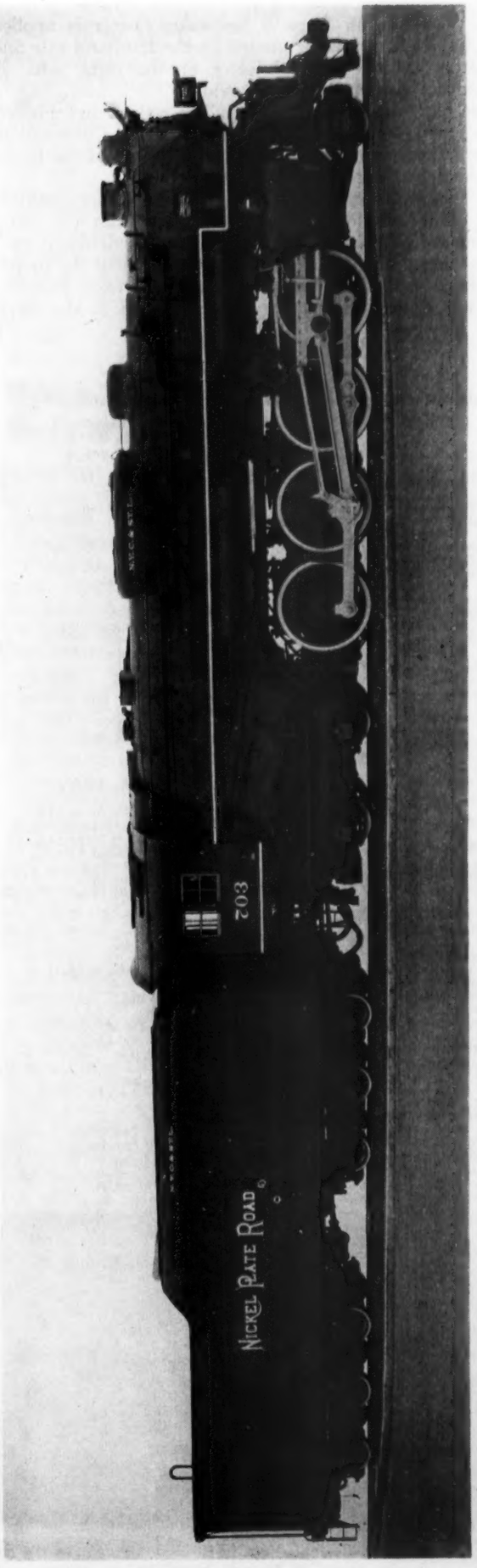
The grate area is 90.3 sq. ft., the grates being of the Firebar type. Three combustion tubes, 2 in. diameter, are provided on each side of the firebox together with suitable steam nozzles. The stoker was furnished by the Standard Stoker Company.

There are 77 2¼-in. tubes and 202 3½-in. flues, both tubes and flues being hot drawn seamless steel. For 10 engines they were supplied by the National Tube Company and for five engines by the Pittsburgh Steel Products Company. The length over tube sheets is 19 ft. The superheater is Elesco Type E and has an area of 1,992 sq. ft. heating surface. Flexible and rigid staybolts were supplied by the Flannery Bolt Company.

The evaporative heating surface totals 4,818 sq. ft., of which 462 sq. ft. is in the firebox, including arch tubes and syphons, and 4,356 sq. ft. in the tubes and flues.

The smokebox is 89 1/16 in. outside diameter and 116 in. long. The smoke stack, the top of which is 15 ft. 8 in. above the rails, has a diameter of 21 in. The exhaust nozzle is 8½ in. diameter. All auxiliary exhausts have been kept outside of the smokebox. This has the effect of keeping all water and condensation out of the smokebox and should improve the drafting.

[4] *Railway Mechanical Engineer*, November, 1927, page 709.
[5] *Railway Mechanical Engineer*, September, 1928, page 491.



One of the fifteen 2-8-4 type locomotives built for the Nickel Plate by the American Locomotive Company

Elevation and cross sections of the 2-8-4 type locomotive built by the American

A Worthington Type S feedwater heater is applied with hot and cold water pumps on the left-hand side and a Nathan Simplex NL injector on the right side. A Nathan low-water alarm is provided.

The blow-off equipment, including valves and muffler, were furnished by the Wilson Engineering Corporation, the centrifugal muffler being located on top of the boiler immediately back of the safety valves.

A 9½-in. drypipe leads to the American multiple front end throttle. As will be noted from the illustrations, these locomotives present a particularly neat appearance. This is due partly to the fact that the piping had been placed under the jacket wherever possible. Another noticeable feature of the design is the large

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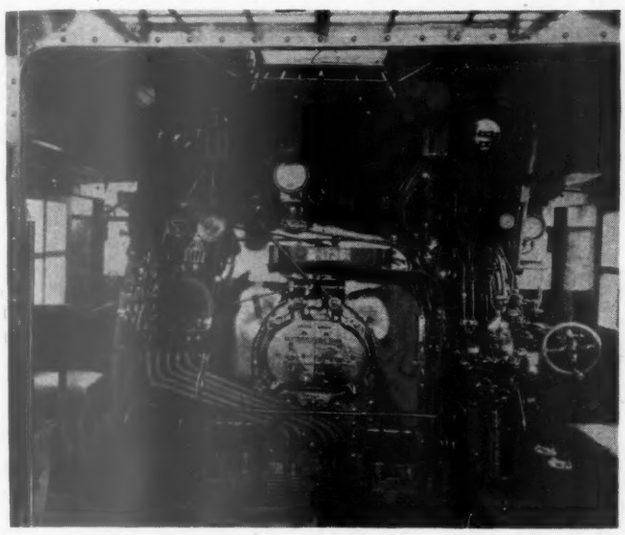
Table of Dimensions, Weights and Proportions of the N. Y., C. & St. L. 2-8-4 Type Locomotives

Railroad	N. Y., C. & St. L.
Builder	American Locomotive Co.
Type of locomotive	2-8-4
Service	Fast freight
Cylinders, diameter and stroke	25 in. by 34 in.
Valve gear, type	Baker
Valves, piston type, size	14 in.
Maximum travel	8 in.
Outside lap	1 11/16 in.
Exhaust clearance	1/16 in.
Lead in full gear	3/16 in.
Specified weights in working order:	
On drivers	254,000 lb.
On front truck	53,000 lb.
On trailing truck	109,000 lb.
Total engine	416,000 lb.
Tender	358,000 lb.
Wheel bases:	
Driving	18 ft. 3 in.
Rigid	18 ft. 3 in.
Total engine	42 ft. 0 in.
Total engine and tender	87 ft. 8¾ in.
Wheels, diameter outside tires:	
Driving	69 in.
Front truck	33 in.
Trailing truck	F. 36 in.—B. 43 in.
Journals, diameter and length:	
Driving, main	R. 12½ in. by 13 in.; L. 12½ in. by 13 in.
Driving, others	R. 11½ in. by 13 in.; L. 11½ in. by 13 in.
Front truck	6½ in. by 12 in.
Trailing truck, front	7 in. by 14 in.
Trailing truck, back	9 in. by 14 in.
Boiler:	
Type	Conical
Steam pressure	245 lb.
Fuel	Soft coal
Diameter, first ring, inside	86 in.
Firebox, length and width	135 1/16 in. by 96¼ in.
Height mud ring to crown sheet, back	68 in.
Height mud ring to crown sheet, front	92¾ in.
Combustion chamber length	42 in.
Tubes, number and diameter	77—2¼ in.
Flues, number and diameter	202—3½ in.
Length over tube sheets	19 ft. 0 in.
Tube spacing	F. ¾ in.—B. 11/16 in.
Grate type	Fire bar
Grate area	90.3 sq. ft.
Heating surfaces:	
Firebox and comb. chamber	343 sq.ft.
Arch tubes	19 sq. ft.
Syphon	100 sq. ft.
Firebox, total	462 sq. ft.
Tubes	857 sq. ft.
Flues	3,499 sq. ft.
Tubes and flues	4356 sq. ft.
Total evaporative	4,818 sq. ft.
Superheating	1,992 sq. ft.
Comb. evaporative and superheating	6,810 sq. ft.
Tender:	
Style	Rectangular W.B.
Water capacity	22,000 gal.
Fuel capacity	22 ton
General data estimated:	
Rated tractive force, 85 per cent	64,100 lb.
Potential (boiler) horsepower	4,008 hp.
Speed at 1,000 ft. piston speed	36.2 m.p.h.
Piston speed at 10 m.p.h.	276.1 ft.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent.	61.0
Weight on drivers ÷ tractive force	3.96
Total weight engine ÷ comb. heat. surface	61.0
Boiler proportions:	
Tractive force ÷ comb. heat. surface	9.41
Tractive force × dia. drivers ÷ comb. heat. surface	649
Firebox heat. surface ÷ grate area	5.11
Firebox heat, surface, per cent of evap. surface	9.59
Superheat, surface, per cent of comb. heat. surface	29.2
Comb. heat surface ÷ grate area	75.4

Special Equipment Applied on N. Y., C. & St. L. 2-8-4 Type Locomotives

Railroad	N. Y., C. & St. L.
Builder	American Locomotive Co.
No. ordered	15
Boiler:	
Boiler and firebox steel	Otis
Rivets	Champion—Victor
Brace rods	Ewald
Staybolts, flexible and rigid	Flannery
Tubes and flues (10)	National Tube
Tubes and flues (5)	Pittsburgh St. Products
Syphons, Thermic	Locomotive Firebox
Brick arch	Am. Arch—Security
Smokebox hinge	Okadee
Smokebox netting	Cleveland Wire Cloth—No. 398
Superheater	Superheater Co.—Type E
Throttle valve	American Multiple
Lagging (10)	Johns-Manville
Lagging (3)	Philip Carey
Pipe covering	Union Asb. & Rubber Co.—Insu-tape
Feedwater heater	Worthington—Type S
Feedwater check	Nathan
Injector	Nathan—Simplex NL
Injector check	Nathan
Blow-off cock	Wilson
Blow-off muffler	Wilson
Washout plugs	Huron
Arch tube plugs	Huron
Stoker	Standard Stoker
Firedoor	Franklin—No. 8
Grates	Waugh—Firebar
Grate pins	Am. Ry. Products
Cabs; Fittings; Boiler Mountings:	
Safety valves	Coale
Steam gages	Star
Back-pressure gage	Ashton
Water column	Nathan—W.O.A. type
Water gage	Okadee
Gage cocks	Central Valve
Low water alarm	Nathan
Blower fittings	Barco
Turret valve	Nathan
Cocks and valves	Central Valve
Whistle	Nathan
Bell ringer	Viloco
Sanders	Viloco
Headlight generator (10)	Sunbeam
Headlight generator (5)	Pyle-National
Headlight	Sunbeam
Cab lamps	Adams & Westlake
Classification lamps	Adams & Westlake—Adlake
Marker lamps	Adams & Westlake—Adlake
Back-up lamp	Pyle-National
Flexible joints and connections	Barco
Universal joints	Hancock
Pipe fittings	A.R.A.—Crane
Cab clear-vision window	Prime
Cab windshield	Prime
Cab seats	Van Dorn Iron Wks.
Running boards	Diamond plate
Cylinders and Driving Gear:	
Cylinders	Ohio Steel Fdry.—Cast Steel
Bushings, cylinder and valve	Alco—Ni-Iron
Piston valves	Alco
Piston and valve packing rings	Hunt-Spiller—Duplex
Valve gear	Baker
Reverse gear	Franklin—Precision
Metallic packing, piston and valve rod	Garlock
Crosshead	Ohio Steel Fdry.—Multiple-bearing
Crosshead wrist pin	Security
Cylinder cocks	Okadee
Frames and Running Gear:	
Main frames	Ohio Steel Fdry.—Cast steel
Frame cradle	General Steel Castings
Bumper	Ohio Steel Fdry.
Wedges, adjustable	Franklin
Bearings, driving-box, etc.	Magnus
Driving-box cellars	Alco—with spreader
Driving-box cushioning device	Alco
Driving-wheel tires	Ry. Steel Spring
Engine-truck wheels	Ry. Sales—Armco
Trailing-truck wheels, front	Ry. Sales—Armco
Trailing-truck wheels, back	Alco
Trailing-truck tires, back	Ry. Steel Spring
Drawbar	Franklin—Unit Safety
Radial buffer	Franklin
Coupler, engine	Buckeye
Coupler pocket	American Steel Fdry.
Coupler rigging	Union Metal Prod.—Imperial
Engine truck	Gen. St. Cast.—2-wheel outside bearing
Trailing truck	Gen. St. Cast.—4-wheel Delta
Springs	Ry. Steel Spring
Lubrication:	
Lubricator, mechanical (10)	Detroit
Lubricator, mechanical (5)	Nathan
Lubricator, hydrostatic	Chicago
Rod lubrication	Reliance M. & S. Wks.—Spee-Dee
Misc. lubrication	Alemite
Brakes:	
Operating brake	New York—6ET
Reservoirs	70,000 cu. in.
Driver brake	American
Brake shoes	Am. Br. Shoe—Dia. S. Perfecto
Train control (10)	Union Sw. & Signal
Tender:	
Tender frame	Gen. St. Cast.—Water bottom
Tender trucks	Buckeye—6-wheel
Tender-truck wheels	Am. St. Fdry.—Davis
Truck brakes	Am. St. Fdry.—Clasp
Draw gear	Cardwell-Westinghouse
Tender coupler	Buckeye

Tender-coupler yoke	Buckeye
Tank valve	Powell
Suction hose	Goodyear
Hose strainer	Okadee
Miscellaneous:	
Steel castings, miscel.	Gen. St. Cast.
Paint, etc.	Glidden—Ripolin



A roomy cab with well-located equipment is a feature of the Nickel Plate locomotive

size sand box which has a capacity of 60 cu. ft. The customary pilot has been practically eliminated, but ample safety steps have been provided.

The cab is large and roomy and the location of all valves and fixtures has been worked out carefully to provide maximum accessibility and visibility. The cab is fitted with Prime clear-vision windows and windshields. The seats are of the Van Dorn pattern, two seats being fitted on the left side.

The chassis is of the built-up construction type. The cast-steel bar frames were furnished by the Ohio Steel Foundry Company and the frame cradle castings by the General Steel Castings Corporation. The cross-ties are of unusually rugged construction, the guide yoke cross-tie being of a heavy box-section design. Sliding shoe supports for the boiler are used at both front and back of the firebox. Particular attention has been given to the bolting of all parts, especially the cylinders which are of cast steel furnished by the Ohio Steel Foundry.

The distributing valves are of the piston type, 14 in. diameter with 8-in. travel. The outside lap is 1 11/16 in., the exhaust clearance 1/16 in. and the lead in full gear 3/16 in. The valve gear is of the Baker type controlled by a Franklin Precision type reverse gear. The piston rods are 5 in. diameter, both piston rods and valve rods being packed with Garlock metallic packing. The crossheads are of the multiple-bearing type and are fitted with Security wrist pins.

The driving wheels are 69 in. diameter with 62-in. centers. The driving boxes have Alco cellars with spreaders and are provided with Alco driving-box cushioning device. Franklin adjustable wedges are also provided. The two-wheel engine truck, which is of the General Steel Castings design, is of the outside-bearing type and has 33-in. rolled steel wheels. The trailing truck is of the Delta four-wheel type, the front wheels 36-in. rolled steel and the back 43-in., steel tired.

The air-brake equipment, which was furnished by the New York Air Brake Company, includes two 8½-in. cross-compound pumps which are mounted in front, ahead of the cylinders. There are three main reservoirs, two 18½ in. by 108 in., and one 18½ in. by 72 in., with a combined capacity of 70,000 cu. in. The brake valves are pedestal mounted. The driver brakes are American, Style WN. Union Switch & Signal Company train control is applied to 10 locomotives.

The tender is of large size, has a water capacity of 22,000 gal., and a coal capacity of 22 tons. It is of the rectangular type with a cast-steel water bottom. Particular care was given to the design of the tank bracing. The trucks are of the Buckeye six-wheel type with 33-in. Davis steel wheels, 6½-in. by 12-in. journal axles and clasp brakes furnished by the American Steel Foundries.

Boxpok Locomotive Driving-Wheel Center

THE improved cast-steel locomotive driving-wheel center illustrated has been designed particularly to meet modern operating requirements and is now in service on a number of railroads, being adapted for application on both new and existing locomotives. It is manufactured by the General Steel Castings Corporation.

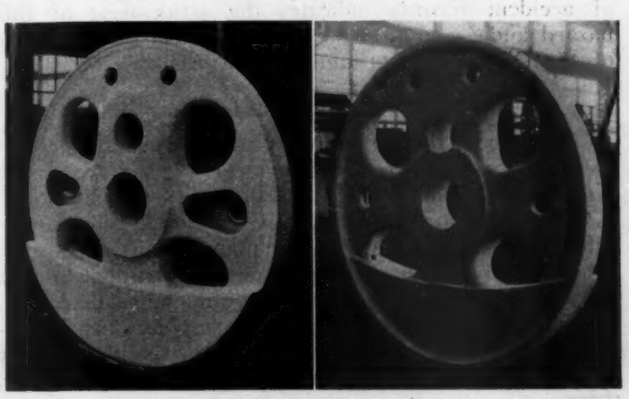
The Boxpok (box spoke) driving-wheel center, as the name indicates, is characterized by having box-section spokes instead of spokes of the usual solid type. In addition, it has a rim of box section. The better and more economical distribution of metal made possible with this design provides greater strength with less weight and also enables the foundry to produce superior castings.

The box-section rim construction, with supporting walls on both sides, has much greater strength and a more uniform tire support and is designed to prevent the development of out-of-round wheels and flat spots. This should increase tire mileage and reduce wheel maintenance. The Boxpok design also has greater strength to resist piston thrusts, lateral forces and impacts from rail, as well as an improved construction between the crank-pin hub and the rim.

The large openings provided in this wheel center give greater accessibility for application and removal of parts, inspection of spring rigging, and lubrication of driving boxes, pedestal shoes and wedges.

The Boxpok design of wheel, with its better utilization of metal, makes it possible to cross balance and to improve counterbalance conditions.

In the development of the Boxpok driving-wheel center, the General Steel Castings Corporation has had the collaboration of the American Locomotive Company and the American Steel Foundries.



Two views of the new Boxpok cast-steel driving-wheel center, as designed for 68-in. main wheels

An Intimate Chat with a Division Superintendent*

Tells the Editor of some of his problems in dealing with mechanical matters

THERE are, of course, all sorts of division superintendents—those on thickly congested trunk lines or at important terminals, and those on railroads serving large areas but with few trains and low traffic density. Or sizing up the situation from a different angle, we have the superintendent under the so-called divisional type of organization, in which he is more or less supreme on his division, the other departments reporting to him. As against this, we have the superintendent under the departmental system, where he deals more or less indirectly with the technical departments. The title does not mean a great deal until one knows more definitely the type of railroad and the nature of the traffic. In the last analysis, however, the division superintendents of all these different types have certain common responsibilities and common problems.

Embarrassing Details

"Do you have any special difficulties in dealing with the mechanical department?" I asked the Division Superintendent of a heavy traffic line—a man of long and successful experience, and a keen observer.

"We get along together very well," he replied, "but there is one thing that I have never been able to understand. Why is it that the mechanical department is so inflexible when it comes to correcting details in design which cause irritation in the operating department? True, many of these things are of comparatively minor importance, but why so much inertia and apparent lethargy? We have been pounding for many years to have some of these comparatively unimportant changes made, but for some reason or other, we don't seem to get much constructive action."

I asked him about certain of these details, but if I were to quote him here it is quite probable they would be recognized and the Division Superintendent might be subjected to embarrassment. He made his point in a decided fashion, however.

"There is another thing," continued the Division Superintendent, "in which the mechanical department is more or less helpless, but which gives me a lot of concern, and that is the arch-bar trucks. I hope that the time will not be extended much further before all of these trucks will be taken out of service. An analysis of accident records indicates the seriousness of this hazard and certainly they do not help to make the life of the Division Superintendent any easier."

Personnel Problems

"How about the personnel of your mechanical department? Do you have difficulty in getting and keeping a high type of mechanical supervisors on your division?"

"We have done very well," replied the Division Superintendent; "indeed, much better than circumstances warrant. As you know, our mechanical-department officers work under strenuous conditions, and more than that, there is often the question of legal responsibility if anything goes wrong. If you compare the conditions under which these men work and the salaries they receive, with the superintendents of small plants along the line, you will find that the latter operate under much easier and less exacting conditions and yet are much better compensated."

"Do you notice any adverse reactions because of this policy?" I questioned.

"Yes, decidedly so," replied the Division Superintendent. "There was a time when I could get high grade students from colleges to enter the service. In more recent years we have not been getting the pick of these men, although, of course, under present conditions we have no difficulty in getting all the help of this kind that we need. I anticipate a difficult time, however, in securing the best type of these men and even in holding the good men we have, when general business picks up."

Propinquity versus Ability

This led to some reminiscing and reviewing of past performances. The Division Superintendent frankly admitted that in a very large railroad organization men of lesser ability are sometimes put into important positions because the talents of men who are better adapted for these positions are not known to those who have the influence or authority to make the promotions. In other words, propinquity in some instances is a considerable factor in selecting the men for promotion.

"In light of these facts," I said, "what can the ambitious young man do to be sure that his talents are not overlooked and that he will not be lost sight of?"

"That is a rather difficult problem," replied the Division Superintendent. "Generally speaking, however, I would say that the young man must do everything he can to extend his contacts and in a diplomatic and tactful way get people to know of his ability. The trouble is, if one is too aggressive in pushing himself that he may make enemies, or at least he may incur the displeasure of people who can interfere with his advancement. That is one reason why I feel strongly that real diplomacy and tact must be used in extending acquaintanceship and building up contacts, which may bring a capable young man into touch with those who may be in position to help in his climb up the ladder.

"Just one other bit of advice to the young men," he continued. "Tell them not to specialize too highly. This is quite likely to lead into a blind alley. If they do specialize, they should be sure that a way will be left open for advancement. My advice is, don't let your specialty be a hobby."

Help to Get More Business

"In what other way can the mechanical-department employees co-operate with you to greater advantage?" I inquired.

"By helping to sell the railroad to people with whom

* Sixteenth of a series of interviews with men outside the mechanical department, commenting in a constructive way on the possibilities of that department.

they deal, or with whom they come in contact," replied the Division Superintendent. "I do not mean that the employees should make a nuisance of themselves in trying to get business from people with whom they deal, but there are many ways in which, in a quiet, effective way, they can build up goodwill toward the railroad and get business for it. In this way they will really safeguard their own interests. The more business the railroad gets, the more men it will employ and the better wages it can pay."

"Specifically, just how can they help?" I inquired.

"We have had very good results," replied the Division Superintendent, "where employees have tipped us off to the fact that certain of their friends were thinking of making long trips, or that new plants were being built in their neighborhood. The difficulty is that too frequently employees seem to think that the traffic and operating officers of a railroad receive this sort of information automatically; as an actual fact, in some instances employees have called our attention to new plants which were contemplated or being built, concerning which we were entirely unaware. It is better to receive too many tips about things of this sort than none at all, since it is important that our operating and traffic men follow up these leads promptly in the effort to secure business."

Underframes for D. L. & W. Diesel-Electric Locomotives

By F. H. Brehob*

Welded underframe using standard plates and shapes designed to meet low weight requirements. Deflection between center plates, 24.5 ft. apart, held to within ¼ in.

FOUR 600-hp. Diesel-electric locomotives, in which the main frame supporting the apparatus and cab is of welded construction, have been built by the General Electric Company for switching service on the D. L. & W. Two more such locomotives are now under construction for the same railroad.

The construction is a rather radical departure from the conventional type of underframe, which is usually either of riveted construction or of cast steel. The frames of these locomotives are believed to be the largest of welded construction. The frame is approximately 42 ft. long, 10 ft. wide and 25½ in. high at the draft-gear housing. It is made entirely of structural shapes and plates, except for cast-steel center plates. The center plates, however, are also welded in place.

On several types of locomotives, depending upon service and other features, it is difficult to build a locomotive within the desired weight, especially a self-propelled design which carries a power plant. The designers of this locomotive have given a great deal of study to welded construction, utilizing standard plates and shapes to secure light construction with reasonable manufacturing cost.

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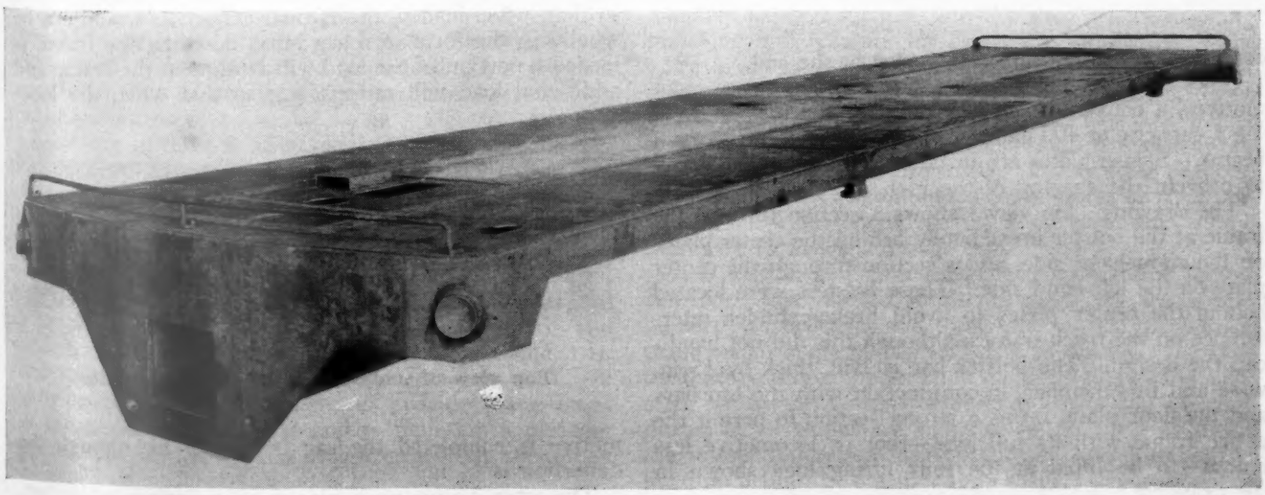
The underframe or platform carries a load of 128,000 lb., not including the weight of the frame itself which weighs 28,000 lb. The largest items of weight carried by the underframe are two engines at approximately 20,000 lb. each and two generators at 9,500 lb. each.

The frame had to be designed with sufficient strength so that the deflection between center plates, which are



Welded underframe for General Electric 600-hp. oil-electric locomotive for D. L. & W.

the supports, did not exceed ¼ in. from center plate to center plate, a distance of 24½ ft. While the stresses are reasonably low, the requirements of deflection were limiting. The engines are bolted to the platform, the engine bases having a flat surface the entire length of the engine for a distance of about 8½ ft., thereby requiring a support having a low deflection. Excessive deflection in the frame would place severe stresses on the engine frame with resultant detrimental effects. The deflection which does occur under the engines is taken care of by soft wood fillers and engine bolts with springs. Another reason for limiting the deflection to ¼ in. is to prevent buckling of the cab side sheets.

To provide for the loading with the above requirements two 13¼-in., 126-lb.-ft. H-beam sections were selected, reinforced at top and bottom with ⅜-in. plates to make a box section. The top plate also forms the floor plate. The main beams were spaced so as to provide for bolting down the engines on the outside flanges. This spacing was also suitable to make a good

Bottom view of partially constructed underframe in the shop during welding process

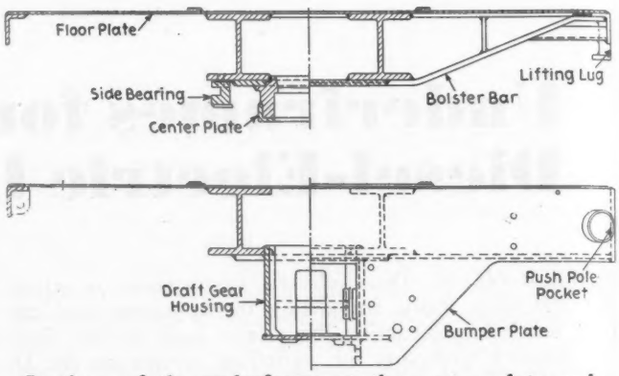
construction of the draft-gear pocket at the end.

Since space is nearly always at a premium on locomotives, a convenient storage tank for the fuel oil, having a capacity of 400 gallons, is located between the main beams. Splash plates are installed crosswise of the tank to prevent the surging of the fuel.

The drawing (top view) shows a section through the frame at the bolster immediately behind the center plates on the right-hand side, and a section through the center plate on the left-hand side. These bolsters were located behind the center plates to avoid brake-cylinder interference on the truck frames, although this did not handicap the design. The bolster bar is 1-in. thick by 15 in. wide and this member, in conjunction with the top bars and the floor plate, forms a strong section to permit the entire frame with its full load—that is, locomotive less trucks—to be lifted at the four lifting lugs shown in the drawing.

The lower view in the drawing shows a section through the draft gear housing on one side and an end view of the bumper plate on the other side and shows how the draft-gear housing is joined to the main beams of the frame. The arrangement of plates in the draft-gear housing is such as to obtain as much direct transmission of load as possible since great strength is required for the buffing and pulling forces. The center of the draft gear through which the pulling or buffing force is exerted is approximately 16⅜ in. below the neutral section of the main beams.

The frame is designed to withstand a buffing force equal to a static load of two and one-half times the weight



Sections of the underframe at the center plate and draft gear housing

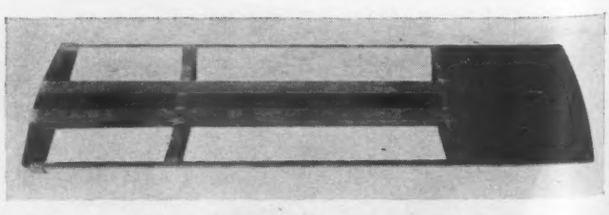
of the locomotive, or 500,000 lb. applied at the drawbar. To provide for this bending moment and direct stress of compression due to the buffing load requires unusually strong construction. To help gain this strength a plate 1 in. thick by 30 in. wide extends from the draft-gear housing to a point beyond the center plate and forms a strong pocket for mounting the center plate.

The end plate on the frame, or, rather, the bumper plate, is 1 in. thick and is securely welded to the beams and draft-gear housing structure and helps to join these two portions.

Method of Construction

The main beams were machined to length and to the desired shape after having first been mated and selected for initial camber.

Whatever initial camber existed in the main beam was used to help provide the frame with an initial crown so that, when loaded, the normal deflection would not be wholly in the form of a sag; that is, when the frame is loaded a portion of the load will straighten the frame and additional load will cause a sag so that when the loco-



Top view of underframe during construction

motive is completed the sag is not ¼ in., though the deflection is ¼ in.

The main beams were placed on a surface table, bottom side up, preserving the camber by placing shims

under the ends of the beams before clamping them down to the surface table. Next, the bottom plates were welded in place, then the bolster bars, which had previously been forged to shape, were welded in place. Following this, the plates forming the draft-gear pockets were put in place and welded, also the end plates or bumper plates, together with necessary minor shapes and plates, to form the desired pocket with projections for mounting the draft gear and coupler.

The plate into which the center plate fits was carefully machined so that the center plate, which is also machined, would make a tight fit in the hole, after which the center plate was further secured by welding.

After doing as much work as possible with the frame upside-down, the frame was turned right side up and supported on the lifting lugs which provided a shorter span than normal between center plates, consequently this helped to preserve the initial crown.

Next the top plates were welded on. The seams between plates were welded first before welding along the sides in order to reduce strains due to expansion and contraction to a minimum.

The principal welds are ¾ in.; that is, each leg where it joins two members is ¾ in. and smaller, depending on thickness of adjoining members. In order to prevent excessive heating and, consequently, excessive warping these large welds were built up in three operations, allowing the welds to become practically cooled before proceeding with the succeeding weld. Care was exercised to be sure that the metal of the joining members was fused to a proper depth and different layers of welds fused properly to each other. Special care was taken to secure oil-tight welds on the members forming the oil tank.

A special welding rod, known as No. W-20, was used. This rod utilizes the covering which burns to provide a reducing atmosphere and a slag covering which prevents oxidation of the weld. This type of rod also produces a weld similar in physical characteristics to the shapes which are welded.

Designing Welded Passenger-Train Cars

By L. F. Seelar

Practices to be considered in taking advantage of economies made available by use of the arc-welding process of assembling component parts

COST of fabrication and building of passenger-train cars can be materially reduced through the use of arc welding and the strength of the frame materially increased without any increase in overall weight. This reduction in cost, which begins in the design and ends in maintenance of the cars, affects both material and labor.

Savings originate with and are largely controlled by the design and it is important that the designer have a thorough knowledge of materials, their possibilities in fabrication, shop methods of fabrication and assembly and the use of the arc weld in assembling parts in unusual positions. Overhead and vertical welds cannot be entirely avoided and the design must provide for an efficient weld when made under such adverse conditions. Sub-assemblies that can be made on the floor or bench should be provided for whenever possible and these assemblies should be carefully inspected as soon as finished, so as to reduce the possibility of rejection after being assembled in the car frame. The subsequent addition of reinforcements to assembled parts requires more time than is necessary for the same operation on the bench or floor.

Economy in the use of material is effected by elimination of deep flanges to provide space for rivet attachment and by avoiding duplication of metal required when parts are riveted or bolted together. In one instance a saving of 1,200 lb. was effected through use of a welded frame in place of a riveted frame at the front end of a self-propelled car. A cast-steel end weighed as much as the riveted end and cost $600 more. The welded end cost $200 less than the riveted end. In riveted structures, it is frequently necessary to use fillers to bring parts into alignment, to provide plane bases for the attachment of parts and to maintain a pleasing appearance. In the welded design, nearly all fillers may be dispensed with.

Reduced costs in designing are obtained through saving the time usually employed for laying-out rivet spacings and checking these spacings through the various pieces to be assembled and through elimination of connections. This saving of time continues through the template department and into the shop where marking, punching and reaming for rivets are eliminated.

Parts are assembled by clamps and an occasional small bolt. Bolts may be as small as ⅜ in. and should never be more than ⅝ in diameter. Parts are first tack-welded in position and after the frame is thus temporarily assembled, all flat welds are made. Where long members are welded, such as continuous cover plates or reinforcements, the welds should be made on both sides simultaneously to avoid warping.

It is a good plan to assemble the underframe bottom side up. After all flat welds are made, the frame may be partly turned over and some otherwise vertical welds made on an angle of from 30 deg. to 45 deg. Turning the frame can be completed and the flat welds on top made after which the remaining vertical welds can be completed, either as vertical welds or on an angle by tilting the frame. After the frame is turned over it should be lined up before the flat welds are made. The assembling of parts, usually called fitting, is practically the same for welded and riveted structures, but permanent attach-

ment by welding is much less expensive than attachment by rivets.

The designer must be fully acquainted with the latest development of the art if he is to obtain the best results. This art is progressing so rapidly that standard textbooks are practically obsolete by the time they reach the public, so that it is necessary that the design squads be kept in constant receipt of reports of tests and work accomplished by the various manufacturers of welding equipment and material.

For purposes of design the car frame may be divided into the underframe, side frame, roof, ends, partitions, and equipment supports.

Considering the underframe and the possibilities of savings due to welded as against riveted fabricated steel, or as against a combination of cast and fabricated steel members, when cast steel is used it must be increased 25 per cent in section over rolled steel to meet the specification of the Post Office Department that tensile stresses in cast steel must be at least 20 per cent less than those specified for rolled steel. This requirement at once places cast steel at a disadvantage as regards weight and when compared to the welded structure, it suffers a further disadvantage as to cost.

Bumper Beams and End Sills

Bumper beams, when fabricated, are usually made of channels or flanged plates with top and bottom covers to form U or box sections. For welded construction, this part can be made of plates cut to shape, butted against

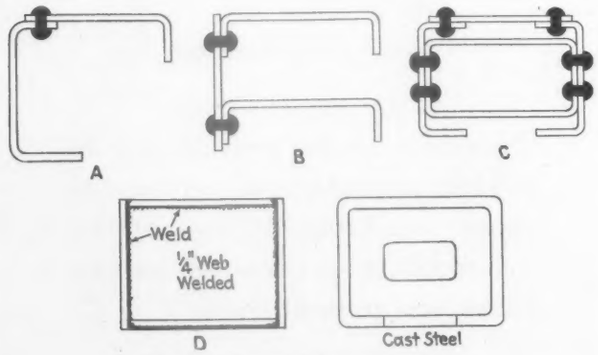


Fig. 1—Bumper beam sections

each other and connected with butt or butt-and-fillet welds. When these parts are riveted together, there is always an opening between them that will admit moisture and the joint will corrode. To prevent this, as far as possible the plates are given a heavy coat of paint when they are assembled and the paint and plaster is frequently inspected and renewed—a heavy maintenance item. When these parts are assembled with a continuous arc weld, it effectually seals the joint against the entrance of moisture, prevents corrosion between the parts and avoids maintenance expense. With all forms of riveted construction, there is a duplication of metal at the joint and this is avoided in the welded joint. There is also an element of slip present in riveted joints that is absent in the welded joint, so that for the same cross section the welded joint is superior in point of weight, strength and maintenance.

Sketches *A, B,* and *C,* Fig. 1 show conventional forms of riveted bumper beams. Sketch *D* shows a welded section with a butt-fillet weld between the top and bottom cover or tie plates and the face plate and a fillet weld between the back plate and the covers. Bumper beams of riveted construction with rolled channel sections are necessarily straight across or of the same cross section from side to center. If built of pressed or drawn-steel sections, the cross section may be varied, but heavy forming dies and equipment are necessary. When bumper beams are constructed with the arc weld no dies are necessary, as the pieces can be sheared to shape. Bending, if necessary, can be done on the break and

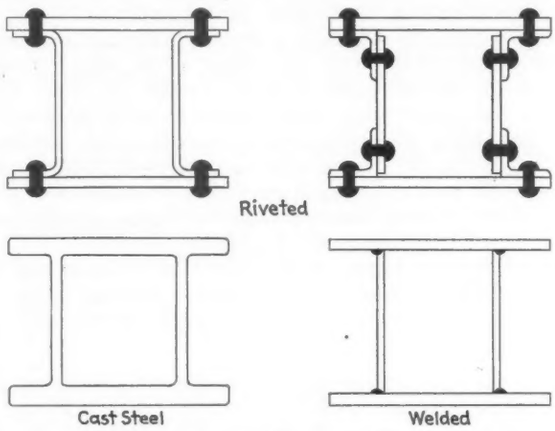


Fig. 2—Bolster sections

forming expense is eliminated. Welded bumpers may be wholly or partly built as a sub-assembly or they may be built as part of the frame.

End sills may be bent plates or rolled sections with anti-telescoping plates welded along the upper edge. Body corner and end posts may be butted on this plate and welded around all contact edges, or the plate may be slotted to receive the end posts, in which case the weld that attaches the posts to the plate seals the opening against the entrance of moisture. So-called "chairs" may be welded to the plate and posts to increase the strength of the end against collapse in collision. The use of the arc weld insures all the end joints against the entrance of moisture and carries the usual saving in labor, handling and material. A light angle will be welded to the top plate of the end sill between the posts and to the posts for the attachment of the end sheathing, when the sheathing does not extend over the face of the end sill.

Bolsters and Crossbearers

Bolsters, Fig. 2, are usually of box cross section of varying depth when riveted and are frequently of box and I section when cast.

When bolsters are riveted, rivet holes are deducted in designing the top or tension members and the top plate

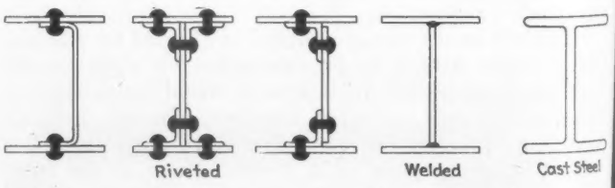


Fig. 3—Crossbearer or needle beam sections

is made thicker or wider than the bottom plate to compensate for this loss of section. There is no loss of section when parts are assembled with the arc weld, and therefore, we have a saving in material in the top member of the bolster. Web plates may be cut to shape and assembled in the car frame by making attachment welds to the side and center sills. Top and bottom mem-

bers may be assembled with tack welds to webs, center and side sills. Side bearing stiffeners, pipe and brake-rod supports or wear plates may be welded to the webs and cover plate before the other cover is put in place.

Ferrules of sheet steel may be passed through the bolster webs and welded in place. These ferrules at once form a seal against the entrance of moisture and form a guide and wear plate for the parts passing through the bolster. Web plates may be assembled with butt or fillet welds. It is possible to attach one plate to the webs with a double fillet weld. In the author's opinion the best construction is to use a butt weld with a small fillet. Direct savings in material and labor by use of the arc weld in constructing the bolsters are elimination of the flanging of the webs, marking and punching rivet holes, making of dies, templates for rivet holes, handling material to and from presses and punches.

Crossbearers or needle beams, Fig. 3, are usually U pressings with top and bottom covers to form an I section of varying depth. Welding this member eliminates the flanges of the web with accompanying savings in handling, punching, forming templates and marking. Construction as an I permits the use of fillet welds on both sides of the web. Welds may be staggered or continuous on one side. If staggered fillet welds or a continuous fillet weld on one side is used, there is an opportunity for moisture to enter between the parts and set up corrosion. It is therefore better construction to use a butt weld, placing a small fillet on the opposite side from which the butt weld is made, as this effectually seals the joint against corrosion. The cover plates are

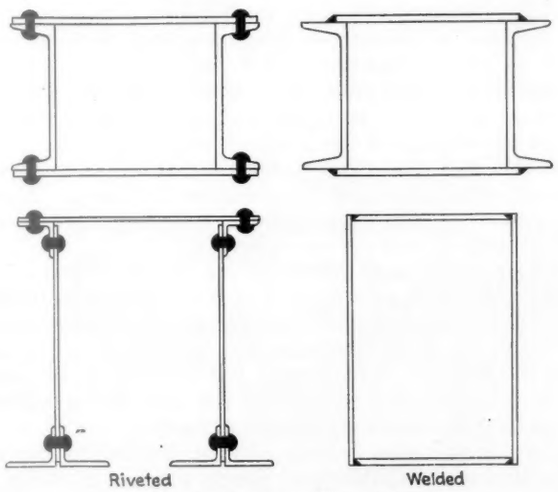


Fig. 4—Center-sill sections

continuous across the car and are welded to side and center sills along all contact edges.

Floor supports are usually of channel section and are often drawn steel pans. A rolled steel Z-section cut square and welded to the side and center sill forms an ideal floor support. For light-weight construction, the Z-section may be made from sheet or plate steel with the flanges turned on a break with a V die. The advantage of the Z-section is that parts may be fastened to either flange with the minimum of interference.

Center and Side Sills

Center sills, Fig. 4, are tied together with a continuous top cover plate and, when of box section, usually have a bottom plate continuous between draft attachments. With riveted construction it is necessary to offset the webs of cross members to allow for the center-sill web flanges and covers, and on self-propelled cars having a steel floor in the cab it is frequently necessary to use fillers to compensate for the varying thickness of cross and longitudinal sill covers. With use of the arc weld it is not necessary that the center-sill covers be a continuous plate from end to end of car. Center sills may be built up box section, fish belly, or a special rolled section when welded construction is used. In arc welding a box-section sill, the cover plates are reduced in width and slightly increased in thickness to maintain the cross section. Using rolled channels for the webs,

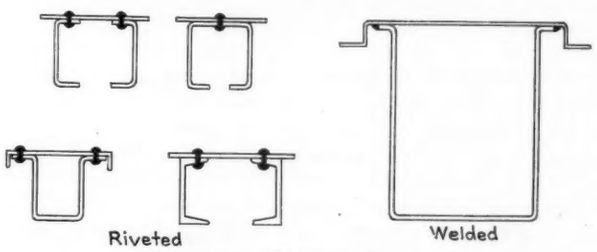


Fig. 5—Post sections

the cover plates are made wide enough to extend ¼ in. beyond the face of the channel web if the flanges are turned outward; if the flanges are turned inward, the cover plate should be 1 in. less than the back-to-back measurement over the channel webs. This permits a continuous fillet weld along the edge of the cover plate and insures against the entrance of moisture.

Cover plates will be cut between the bumper beam and bolster, between the bolster and needle beams and between the needle beams. Butt welds will be made between the cover plates of the cross sills and the center sills so that the entire frame becomes a homogeneous structure. All holes through the center sills should be provided with sheet-steel ferrules and the ferrules should be welded to prevent the entrance of moisture. The arc weld shows the largest saving in the construction of the center sills, as its use eliminates a large amount of detail drafting, templates, marking, punching and handling, of the sills. It is almost always necessary to straighten the long cover plates and this item is eliminated. As before stated, the welding of the cover plates to the center sills simplifies the floor construction and shows a labor saving in this item also.

Side sills are usually a rolled section and they are welded to the bumper beams, bolsters and needle beams along all contact edges. Welds are made so as to exclude moisture between the parts.

Posts and Side Framing

Posts, Fig. 5, are of various cross sections, ranging from rolled steel angles, channels, I and Z's to drawn winged channels and curved sections. Heavy end-post sections used to resist collision stresses remain much the same with arc welded construction as in riveted designs. However, the arc weld simplifies the connection of these members and makes possible a much stronger connection, while reducing its bulk, and eliminates connection angles and gussets. Slots are provided in the welded bumper beam similar to those in cast-steel ends and the posts are welded to both upper and lower bumper plates. The upper ends of posts are welded to the anti-telescoping plates, which are slotted for their reception so that the welded joint is simpler and stronger than a riveted attachment.

Side posts are usually of channel or winged-channel section. In either case, the flanges can be decreased in

width and they can be welded to the side sill and plate and to the sheathing. For the welded joint, flanges should have a width equal to not more than three times the thickness of the post. Twice the thickness is ample for the thinner sections ⅛ in. and less. Posts should be flanged to give them stability while being handled. This also makes a better welding proposition, as the welder can work along the edge of the plate where it is in contact with the sheathing and sills. It is much easier to hold a straight line with a flanged post than with one having sharp edges. A suggested section for a side post for use on a car with stationary windows or glass is one with a winged-channel inner portion and a cover with

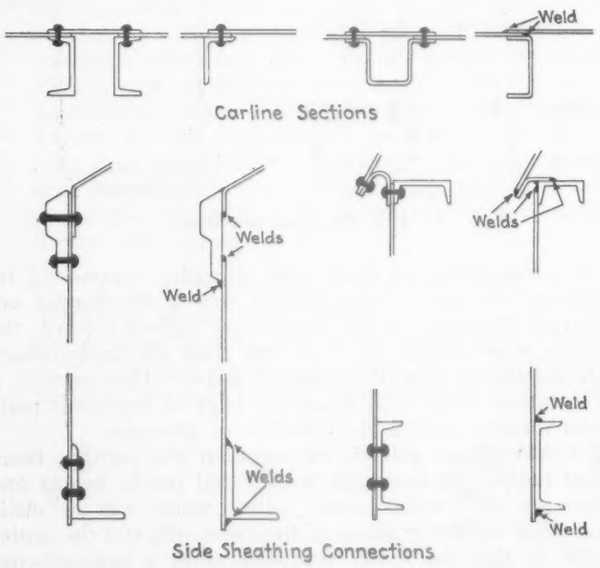


Fig. 6—Side-sheathing connections

a reentrant angle flange that can be welded to form a weather-proof frame for windows.

Side plates of channel, angle or Z-section are attached to posts and telescoping plates with fillet welds.

Carlines of channel section are made up on the bench in pairs and are then attached to the side plates with fillet welds along contact edges. Purlins of channel section can be welded between carlines. The elimination of riveted connections in the carlines and purlins facilitates the building of a smooth strong roof.

Roof sheets are lapped on the flanges of the carlines and attached to them with fillet welds. Small holes for location bolts or screws should be placed in the roof sheets. Holes should be spaced about 30 in. centers and should be puddled welded after the sheets are attached to the carlines. Framing for ventilators, light supports and air ducts can be made as sub-assemblies on the bench and then be welded in place in the roof frame so as to form a stiffening for the structure. These frames may be so designed as to be less in weight than the furrings now used and will increase the strength of the roof frame.

Side Sheets may be held in place with a few small bolts, C-clamps or magnetic clamps while being tack welded. Welding of the side sheets should be carefully done to prevent buckles and, as a smooth weld reduces grinding and plastering, the extra time spent by the welder is compensated for by the saving in the finishing labor. Car sides have been built straight or flat as a measure of economy, but the saving in bending posts and in fitting parts is often lost in trying to remove buckles in the sheathing. A small draw-in on the sides can be easily built into the car and it will eliminate the buckled appearance of the flat side. This draw-in should be included in all welded construction, as it enhances the appearance of the car.

When side sheets are welded in place, the welds should be continuous along all edges. Sheets should extend ¼ in below the side sill and welds should be placed along the bottom edge of the sheet and also along the top edge of the side sill to prevent the entrance of moisture as well as to insure a firm attachment of these parts. Welds between posts and side sheets should also be continuous. It is much better to have a continuous ⅛ in. fillet than a heavier fillet in short sections, as the continuous fillet insures the equal transmission of strains and forms a weather seal. It is possible to use lighter sections with welded construction on account of the elimination of corrosion hazards, the uniform distribution of strains and the absence of "slip" in the joints. Also, the welding makes a homogeneous mass of the contiguous parts, so that more material can be assumed as resisting imposed loads and a corresponding reduction in cross sections of some vertical members may be made.

Belt rails and window stooling can be welded in place before the side sheets and window sills are put in place. As the belt rail is always of large cross section, the welds attaching it to the posts should be equal to the thickness of the posts. Corners between posts, window sills and belt rails have always been troublesome as they form pockets to catch moisture and dirt. Gas welding and brazing has been used for a number of years to seal these corners. Before and since the advent of the acetylene torch these parts were sealed with copper flashing soldered in place. Neither method has ever been entirely satisfactory as the rivets have always permitted a little motion between the parts and the gas welds have cracked or pulled away and the soldered flashing has loosened. The arc weld has eliminated this trouble as it rigidly connects the parts with a permanent fastening. Every piece can be made homogeneous with its neighbor and detail break-downs are prevented.

Letter panels and eaves can be easily welded along all contact edges with posts, post covers and side sheathing. It is important that the weld along the top edge of the letter panel and the side sheet be continuous to prevent the entrance of moisture. Eaves should be designed so as to permit the removal of the roof sheets without disturbing the fastening of the letter panel.

Interior partition frames may be welded to the car superstructure and the cover panels attached by welds or screws, depending on the material used.

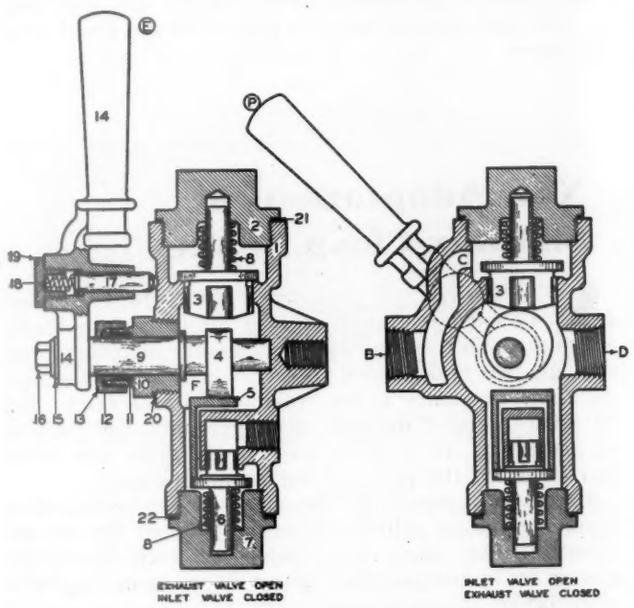
End sheathing can be readily welded to the corner, intermediate and door posts. Ends are always subject to the heaviest collision and operating shocks and the advantage of the continuous weld for tieing the frame together may be most appreciated here.

Reinforcements and frames for doors and windows are more easily assembled and applied by the use of the arc weld on account of the smooth surfaces—unbroken by rivet heads—to which they are applied and also to the fact that the attaching weld weatherproofs all edges while developing the full strength of the part.

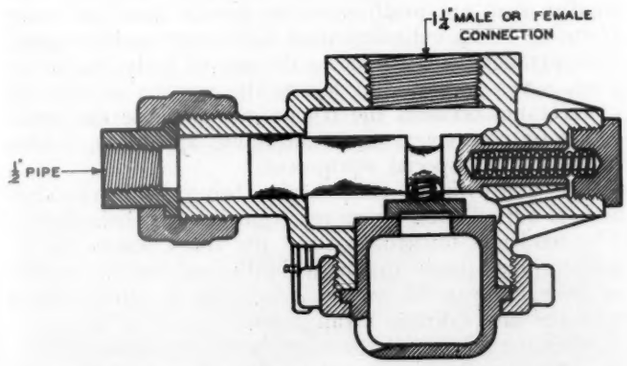
ORGANIST INVENTED LOCOMOTIVE WHISTLE.—The locomotive whistle can claim a musical pedigree. It was invented by an English organist more than a century ago following a grade crossing crash between a train and a farmer's cart on the Leicester and Swannington Railway. In its original form it was not known as a whistle but was called a "steam trumpet."

McLain Locomotive Cylinder Cock

A MAJORITY of the locomotives in this country are equipped with poppet-valve type cylinder cocks which are operated by a series of levers and rods. These cocks seat with the pressure and remain seated until the lever is moved by the engineer, thus raising the poppet valves from their seats and permitting condensation to drain from the cylinders. The



Sectional views of the King operating valve No. 51



Section through the McLain locomotive cylinder cock

objection to this type of cylinder cock is the cost of maintenance of the series of levers, and the fact that if they become bent the cylinder cocks are inoperative.

Some cylinder cocks are operated by compressed air, but the load on the air compressors of modern locomotives is now sufficiently large without coupling another device to it.

The McLain cylinder cock shown here is made by the United States Metallic Packing Company, Philadelphia, Pa. It is operated by steam and consists of a piston which moves a slide valve closing the opening from the cylinder to the atmosphere. Among the advantages claimed for the device are the following: (a) Cylinder cocks automatically open when the engine is dead; (b) if cylinder pressure exceeds boiler pressure by 43 per cent, the cylinder cocks open automatically; (c) slide valve wipes the seat, removing dirt and scale each time the cock is operated; (d) full ¾ in. straight line discharge which may be directed parallel to the right of way or in any direction desired.

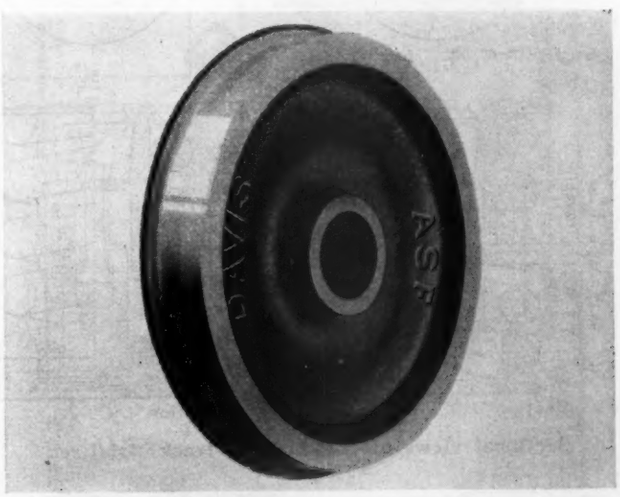
The McLain cylinder cocks are controlled by a King operating valve No. 51, located in the cab of the locomotive, the inlet being coupled to a source of live steam supply and the exhaust piped to the ash pan or some other convenient place where the steam may be exhausted without obscuring the vision of the enginemen.

Whenever the handle of the operating valve is in the position marked "closed", steam flows to the ½-in. inlet pipe of the McLain cylinder cock and moves the piston and the slide valve to which it is connected so as to close the outlet from the cylinder to the atmosphere. When the engineman desires to open the cylinder cocks he moves the operating handle to the position marked "open", whereupon the pressure is shut off from the cylinder cocks and the exhaust valve of the operating valve is opened so as to exhaust the pressure in the line to the atmosphere, whereupon the piston is moved by the spring and the slide valve is pushed across its seat, opening the locomotive cylinders to the atmosphere.

Davis Heavy-Service Steel Wheel

AFTER an extensive period of research, test and development work, the American Steel Foundries began, early in 1933, to manufacture the Davis heavy-service steel wheel for use on passenger cars and tenders. This wheel is made from the same special composition alloy steel and given the same heat treatment as the Davis one-wear steel wheel which has been in extensive use for a number of years.

The special feature of this heavy-service wheel is that it is a multiple-wear wheel with a rim section designed



Davis multiple-wear steel wheel designed to eliminate tread defects caused by heavy service

in accordance with the A. R. A. recommended practice for multiple-wear steel wheels. The rim metal of the wheel has a hardness of approximately 400 Brinell, an ultimate strength in excess of 200,000 lb. per sq. in. and a high degree of toughness.

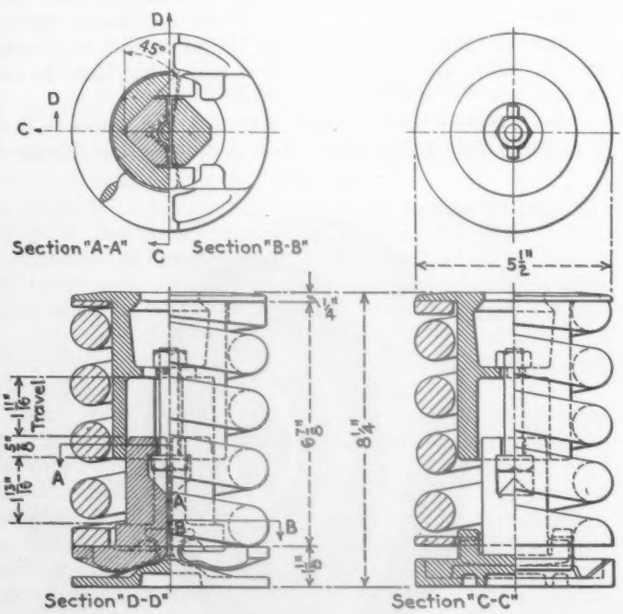
When Davis wheels were first introduced it was ex-

ceedingly difficult to machine the treads on account of the tool and lathe equipment in general use. The developments of the machine tool industry have eliminated this difficulty and for a number of years some roads have been reconditioning the treads of Davis one-wear wheels by turning where it has not been necessary to remove sufficient metal to reduce the rim section to the A. R. A. or I. C. C. condemning limits.

As the Davis heavy-service steel wheel contains sufficient rim metal to permit of three wears, it is a decided improvement over the one-wear wheel for services which require multiple-wear wheels. It is claimed that, because of the special metal characteristics of the Davis wheel, its use in heavy tender service practically eliminates shell-outs and other tread break-down defects caused by heavy wheel loads, this valuable characteristic of the wheel apparently being substantiated by a number of service performance records.

National F-2-A Car Truck Stabilizer

FOR several years the National Malleable & Steel Castings Company has been developing in the laboratory and in service a stabilizer or snubber for car truck springs. The conventional coil spring suspension used in freight car trucks is subject to violent vertical oscillations at certain speeds and this is responsible for a great deal of damage to lading. The series of riding tests



Sectional views of National car truck stabilizer, Type F-2-A

made in the fall of 1933 by the American Railway Association clearly demonstrated the nature of this spring action and showed that the use of properly designed friction stabilizers would prevent the building up of these harmonic oscillations. The National F-2-A stabilizer was included in these A. R. A. tests and was found to eliminate harmonic oscillation at all speeds covered by the tests.

The National F-2-A stabilizer consists of a friction case or housing, a base, two friction levers and a spring which presses the friction levers against the interior surfaces of the housing. One stabilizer is substituted for one coil spring under each bolster end. Any vertical movement of the bolster relative to the side frame causes the levers to generate friction against the interior surfaces of the housing. The F-2-A stabilizer is so designed that proper frictional contact of its parts is maintained regardless of rocking or lateral movements of the bolster.

All parts of the stabilizer are made of the same heat treated alloy steels as are used in National friction draft gears, years of experience having shown that they possess the qualities necessary for maximum shock and wear resistance.

New Adaptations of Simplex Clasp Brakes

A NUMBER of years ago the American Steel Foundries brought out the Simplex clasp brake, which through a system of levers applies retarding force through two brake shoes on each wheel. This arrangement was necessary as the braking load on a single shoe per wheel under modern passenger cars had become so great that the friction between the shoe and wheel had exceeded the point of maximum efficiency.

Later refinements of the clasp brake consisted in removing the air cylinder from the body of the car and mounting two small air cylinders on each truck, this system being designated as the quick-acting unit-cylinder clasp brake.

The truck-mounted cylinders are more accessible for inspection and packing renewals and, owing to their smaller size, are much easier to handle than the heavy 16-in. or 18-in. cylinders used with body brake rigging. This arrangement eliminates the use of body brake rigging, saves weight and leaves the portion of the car underframe between the trucks available for the application of reservoirs, air conditioning apparatus, electrical and other special equipment.

The unit-cylinder clasp brake, being an independent unit, is not affected by curves regardless of their degree. The tendency toward twisting the truck levers on the conventional truck and body brake installation because of the angular pull from the body brake is entirely absent with the unit cylinder arrangement.

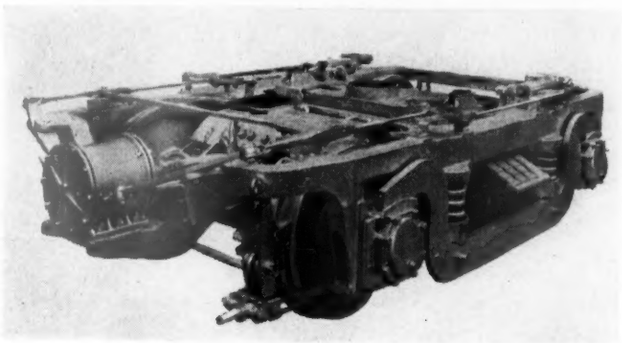
With the advent of the high-speed streamlined trains, an improved braking system especially adapted to the new conditions was essential on account of the low center of gravity and the limited space under the body of the cars. The American Steel Foundries unit cylinder clasp braking system used on the Chicago, Burlington & Quincy Zephyr, involved numerous engineering problems on account of the limited space on the trucks which was available for brake rigging, and the necessity of keeping weights to the minimum.

As the Zephyr is an articulated three-car train, employing a motor truck, two intermediate trucks and a rear truck, it was necessary to design a special clasp brake arrangement for each of the three trucks. The design of the motor four-wheel truck brake involved unusual difficulties as, after the motors were mounted, little space remained for clasp brake rigging or air cylinders. These limitations were overcome by making an extension of the cast steel truck frame on one end and mounting a single air cylinder on this extension,

installing the brake levers and rods above the motors and the truck frame.

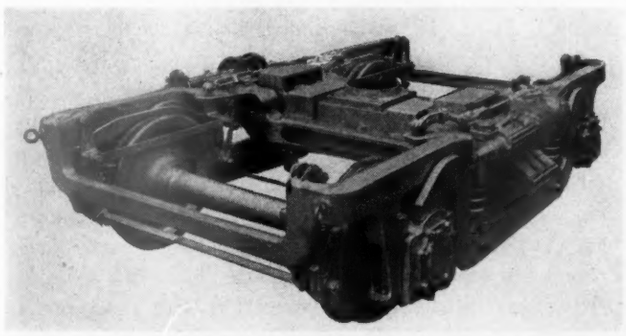
More space was available on the four-wheel intermediate trucks and a small air cylinder with automatic slack adjuster was mounted on each side of the truck frame, as shown in one of the illustrations. This same plan was adopted for the four-wheel rear truck, although of a somewhat different brake cylinder arrangement from the trailer trucks.

In the interest of a high factor of safety, and maintaining weights to a minimum, all parts, including levers,



Simplex quick-acting unit cylinder clasp brake as applied to the front power truck of the Zephyr

pull rods, hangers, etc., were manufactured from alloy steel. All pull rods and slack adjusters were forged solid without welds. All cast parts were made of Hylastic steel, which has a tensile strength of 100,000 lb. per sq. in. and an elastic limit in excess of 65,000 lb. per sq. in. By the use of such high grade steels, a reduction in weight of approximately 30 per cent was obtained. All moving parts, subject to wear, were fitted with high quality, wear-resisting bushings, made from cold-drawn steel tubing, case hardened to the minimum 60 Rockwell "C" scale of hardness and accurately ground both inside and outside to finished dimensions. All pins were made from high-grade steel, case hardened and



Simplex clasp brake application to one of the intermediate trucks of the Zephyr—Air cylinders and slack adjusters are side mounted

accurately ground to specified diameters, and fitted with hexagon slotted nuts and cotters.

To effect the high rate of retardation required to maintain stopping distances from speeds of 100 miles per hour within operating limits, the brake system is designed for a 200 per cent braking ratio at 100 lb. cylinder pressure and the brake cylinder pressure is controlled automatically as the speed of the train decreases. This arrangement maintains a constant predetermined retardation rate and avoids the possibility of slid flat wheels.

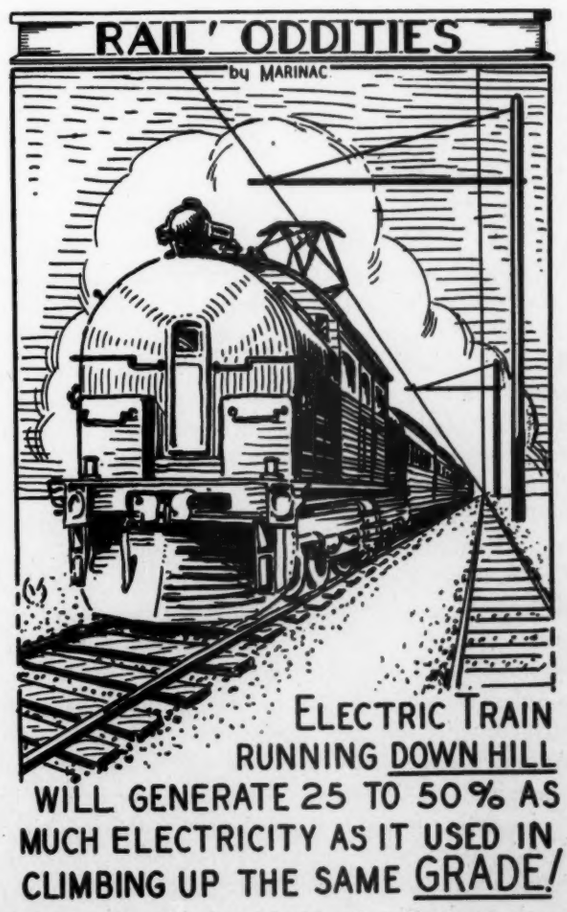
Owing to the fact the Zephyr is a one-way train, or in other words, will always be operated as a unit with the power plant at the front, special features were incorporated in the brake design to assure even brake shoe wear. This involved a change in the usual design of head and mounting so that the center of the shoe pressure would balance the wheel rotation action.

This type of brake is also adapted to produce satisfactory results when applied to standard designs of six wheel passenger trucks.

FIRST LOCOMOTIVE RUN.—The run of the first steam locomotive by Richard Trevithick was made on a bet, according to the New York Times. The famous run was the result of a bet of 500 guineas made between two iron manufacturers that Trevithick's engine would not draw a load from the Penydarren iron works to Abercynon, nine miles down the valley.

Trevithick's own account of the trip is as follows:

"We proceeded on our journey with the engine and we carried 10 tons of iron and five wagons with 70 men riding on them the whole journey. It is above nine miles, which was performed in four hours and five minutes. We had to cut down some trees and remove some large rocks out of the road. The engine, when working, went nearly five miles an hour; no water was put into the boiler from the time we started until we arrived at our journey's end. On the return home, about four miles from the shipping place of the iron (Abercynon), one of the small bolts that fastened the axle to the boiler broke and all the water ran out of the boiler, which prevented the return of the engine until this evening. The gentleman that bet against it rode the whole of the journey with us, and is satisfied that he lost his bet."



Further explanation furnished by the editor upon request

EDITORIALS

Sectional Scales for Weighing Locomotives

The "Chief Engineer," the interview with whom was reported in the October number of the *Railway Mechanical Engineer,* apparently started something when he suggested the installation of sectional scales for accurately checking the wheel-loads of locomotives. Elsewhere in this number will be found a communication from William T. Hoecker, explaining the extent to which European railways provide facilities for determining the individual wheel-loads and the advantages which may be expected from such practice.

At least one American railroad checks up carefully in this respect. "We have found a distinct advantage in the use of sectional scales for weighing locomotives," said a mechanical officer of this road. "We were very much surprised in checking a number of locomotives to find them between 5,000 and 10,000 lb. out, as compared with the specifications. As to the prevention of damage to track, we have no specific information, but feel sure that the correct loading of drivers has more than warranted the installation of these scales."

On the other side of the argument, several mechanical officers have questioned the suggestion of the Chief Engineer. It is claimed, for instance, that the first cost of such scales and the expense of maintaining and operating them is out of all proportion to the benefits that may be expected from their use.

It is contended, also, that the locomotive builders use such scales, and that with reasonable care in maintaining the locomotives as received from the builders, there should be no great variation in the distribution of the weights after the locomotives go into service Occasionally the driving boxes may be keyed up too tight, but this is easily discernible and corrected. There was a time, when the older locomotives generally were being modernized on a large scale, that the addition of new appliances added to the weights or changed their distribution. Most roads, however, have completed their modernization programs and it is claimed that this is not now a serious item to contend with.

One railroad officer suggests that the use of individual scales would cause constant annoyance because of the request that engines be reweighed, the supposition being that such a procedure would be more or less useless unless there has been some considerable change in the construction of the locomotive.

Another mechanical-department officer suggests that "the engineering department has always overlooked the most important factor in connection with driving-wheel weights. Manifestly," he says, "this is not the static weight which would be obtained on scales. Injury to track results more from unbalanced weights due to faulty counterbalance, rather than to inequalities in the static weights. I believe that most of the formulas which are used by the engineering department in designing structures were developed when the influence of unbalanced weights was less than it is now, because the locomotives were much smaller and the weights per wheel were much less, so that these unbalanced forces were not so much a factor in the stresses produced in track and structure as they are now."

We shall welcome further expressions from our readers, either on the basis of actual experience with such scales, or of studies which may have been made as to their possibilities for usefulness.

Reporting Locomotive Defects

Locomotive condition reports usually show the defects and work required, as reported by both enginemen and inspectors. While the reports of some enginemen reflect the true condition of the locomotives, these conditions being corroborated in every detail by the inspectors' reports, certain enginemen allow themselves to indulge in particular hobbies and, consequently, their reports can be forecast almost word for word and give little indication of the real conditions of the locomotives.

For example, as was pointed out at a recent meeting of the Pacific Railway Club, reports frequently include the following: "Engine not steaming," "Engine blows," "Oil engine truck, driver and trailer boxes." It is obviously of no help to the inspectors or the enginehouse supervision for enginemen to report work which will be taken care of normally as a routine operation. It is equally ineffective to concentrate on certain details at the expense of others which may be more important. Maximum benefit from the enginemen's records are secured only when they tell, as nearly as practicable, exactly what the defective conditions are and where they can be located. This is perhaps best illustrated in connection with the reports of engine blowing. When this condition exists, the engineman may just as well add "Examine admission rings (or exhaust rings, as the case may be) on the right valve"; or "Examine right (or left) cylinder packing."

Clear, precise reports by enginemen are extremely valuable to the enginehouse foreman who, in the last analysis, is the man who has to decide what work is non-essential, what can be postponed to some later time and what conditions must be corrected without fail before locomotives can be returned to service.

Smoke Prevention

Communities throughout the country are taking a greater interest in smoke prevention, and undoubtedly this interest will continue to grow in the effort to provide more attractive and healthful conditions. While in most instances the railroads are not the chief offenders—from the standpoint of total smoke production—the smoke from locomotives and enginehouses is very noticeable and the public generally rates the railroads as among the largest smoke producers. The remarkable performance in smoke elimination by the railroads operating in Hudson County, N. J., was commented upon in the October number of the *Railway Mechanical Engineer.*

A unique, and apparently productive, quick survey of air pollution in Scranton, Pa., was made last summer by the Mellon Institute of Industrial Research. The Scranton Republican co-operated in this movement and the survey was made by H. B. Meller and Logan B. Sisson. One usually associates the word survey with long and painstaking research. In this instance the actual observations were made within a week, during the latter part of July, 1933. A thorough survey—or in the terms of the authors of the report, which has just come to hand—"a complete picture would require a year-round study, because seasonal variations in meteorlogical conditions and in the use of fuel are large." However, there is a question as to whether a brief, intensive survey may not answer all practical purposes, at least in the early stages of the movement to improve conditions. Indeed, the report suggests that "the data are to be accepted as *reliably indicative,* rather than wholly conclusive."

Strangely enough, although Scranton is in the heart of the anthracite region, one of the principal sources of smoke is from the bituminous coal burned in locomotives. The other chief contributor to air pollution is dust stirred up by the winds sweeping over the culm piles and barren slopes.

To reduce locomotive smoke it is suggested that as high a percentage of anthracite as practicable be used. This "is based upon the supposition that it will be possible to insure dependability of supply, uniformity of quality and a satisfactory price level over such a period of time as would warrant railroad managements making adjustments necessary to meet the demands for ample power, produced with a minimum of smoke."

It is suggested that a saving in the cost of fuel can be made by mixing as large a proportion as possible of low priced buckwheat with the bituminous coal. It is also suggested that smoke from the building of new fires in the engine terminals can be eliminated. This assertion is made on the basis of results secured in terminals in other cities where special attention has been given to the proper technique for building such fires. Obviously, also, in order to secure real and permanent results, adequate supervision must be provided, although it is suggested that the cost of such supervision may be offset by the saving in fuel and operating costs.

The railroads must have the good will of the public if they are to build up traffic in competition with other types of carriers, and if they are to secure a square deal from the legislators and regulating agencies. With proper care it is possible greatly to reduce the smoke nuisance; it is even contended that in the reduction of this nuisance savings in fuel are made which offset the increased costs of supervision and maintenance. Whether this latter claim is true or not, it would seem that the railroads would be warranted in going a long way in the effort to eliminate smoke as a means of cultivating the good will of the public.

Mechanical Conventions—Two Good Reasons For

Changing conditions in the railway field, as well as in our economic structure, and the possibility of improved business conditions in the not distant future, have been important factors in stimulating a strong interest in the revival of the work of the various mechanical-department associations, and the planning for conventions in 1935. Among the reasons why such activities should be resumed are two which, while of prime importance, are not generally recognized as such.

In the first place, it is now several years since conventions have been held by some of the organizations, and their activities have become almost dormant. In the meantime, because of death, retirement from service and in some cases, demotion, many changes have taken place in the members and officers of these associations. New men have come into supervisory positions, many of whom are very much in need of the sort of coaching and inspiration that they can get by mixing with their fellows from other railroads, exchanging experiences and making contacts which they can follow up to advantage in seeking information. Taking part in committee work and attending the conventions is not only valuable because of the actual knowledge gained and the contacts made, but such experiences are quite likely to prove of great importance in building up the morale and giving a supervisor that confidence which is so necessary in the successful administration of his department.

In the second place, the younger men have been largely overlooked in the depression years. Many of them have dropped out of service and little, if any, recruiting has been done. As business picks up it will be extremely important to remedy this deficiency. Meanwhile, many of the younger men who have been able to hang on, are badly discouraged and are wondering whether, after all, the future in railroad service is worth while. These young men have accumulated a considerable amount of experience and can be made

very valuable to the railroads, if they can be given more encouragement.

One mechanical-department executive is quite insistent that these young men be given consideration in arranging for convention attendance next year, since it may be the turning point in many instances in reviving their interest in railroad affairs and giving them a larger vision of the future possibilities. Certainly they would profit greatly from the experience of attending conventions and this is particularly true if exhibits are available which will permit them to get a good idea of some of the new devices and improved tools and equipment that are now available.

Modernization in Standardization

The development of standards to facilitate the interchange of cars between railways has been the most important function of the Mechanical Division of the American Railway Association. There are, broadly, two reasons for the standardization activities of this organization: (1) the requirements of interchange, and (2) first cost. The most important of the two is the need for standards affecting the repair of cars in interchange, or the ability of cars to withstand the most severe operating conditions to which they may be subjected. This was the major reason for the organization of the Master Car Builders' Association in 1867 and was always the major incentive back of the standardization efforts of that association.

Until just before the war standardization projects were largely confined to details such as couplers, axles, journal bearings, wheels, important dimensions affecting interchangeability of truck parts and draft gears and certain specifications to meet strength requisites in the car structure. Then came the urge for a standard box car, including not only completely standard interior dimensions, but also a complete standardization of the car structure. This was to effect an appreciable reduction in first cost as well as further advantages in interchange. Lacking the urgency which had operated to bring about effective unity of action in the matter of important details, the original standard box-car project did not advance with any degree of rapidity. When the American Railway Association was reorganized following the war, with the merging of the two important mechanical-department associations to form its Mechanical Division, nothing definite had yet been accomplished.

The history of the standard-car developments effected by the Mechanical Division is too recent to need review here. Since 1920 the A. R. A. has adopted a standard stock car, three types of standard box cars and two standard open-top cars. The extent to which these designs have actually been followed in the building of cars, however, has been too small to make the tangible record of achievement in this direction one which can be pointed to with any degree of enthusiasm. These designs have affected the general character of car construction, since their adoption, but they have seldom been adopted as a whole by any railroad.

Increased pressure behind standardization is now suggested by the interest which Co-ordinator Eastman's organization is showing in making effective such standards as have already been adopted. But at the same time we are entering a period in which standardization beyond the essentials needed for orderly interchange has ceased to be desirable. At a time when no important developments in materials or design had taken place for many years standardization by the best utilization of well-known elements seemed to many railway men a logical procedure. With the advent of new materials on the one hand and the growing realization of new requirements for the successful handling of many commodities on the other, standardization beyond that of elements required for orderly interchange and safety of operation, if aggressively pushed, will inevitably serve as a brake on progress. The best method of designing for the use of new materials cannot ultimately be developed until experience has been gained with many designs, each logical enough on paper but not all equally well adapted to the many uncertain conditions of actual service.

The trend of the times is toward centralized control with reduced freedom of action of the individual. Care must be taken that this trend be not allowed to stifle the incentive and energy of individuals—both organizations and men—if the elements of progress now available are to be effectively utilized.

NEW BOOKS

DIESEL ENGINEERING HANDBOOK. *Published by Business Journals, Inc., 192 Lexington avenue, New York, N. Y. 32 pages, 7 in. by 10 in. Pebbled leather binding, engraved in gold. Price, $5.*

The seventh edition of the Diesel Engineering Handbook is somewhat larger in size and broader in its editorial coverage, the treatment being extended to the use of Diesels in the transportation field, particularly railway and automobile service. The first chapter outlines the basic principle of the Diesel engine. The second is devoted to Diesel Economics and is made up of information gathered through contact with users and by employing the data presented before the Oil and Gas Power Division of the A. S. M. E. Other chapters are devoted to developments of new types; planning and installation; electrical equipment in central power stations; water-cooling and purifying systems; lubricating oils and fuels, and operation, care and maintenance of the equipment in Diesel plants, as well as various accessories such as pumps, filter systems and oil purification methods.

THE READER'S PAGE

Sectional Scales for Weighing Locomotives

To The Editor:

On pages 356-7 of the October *Railway Mechanical Engineer,* "Chief Engineer" suggests the desirability of accurately ascertaining the static wheel-loads of locomotives, in order to insure proper weight distribution.

This question has long been given special attention in many foreign countries, where the civil engineer's department generally exerts considerably more influence than is usual on American railways. Facilities for determining individual wheel-loads may be found in the principal shops of practically all European railways. On most foreign locomotives the spring hangers are equipped with so-called "regulating nuts." These are considered necessary, since it is frequently found that although engines leave the shops with weights properly adjusted, after a few trips the springs settle down and further adjustments are required.

When it is considered that foreign axle loads rarely attain 50,000 lb., even on lines laid with rails weighing more than 100 lb. per yard, while 70,000 lb. is common in America, it seems strange that so little regard has been paid to the subject in this country. Some may imagine that only the dynamic augment is of any great importance in its effect on the track and the behavior of the engine, but nothing could be further from the truth. There are recorded instances of leading and trailing trucks being found from 40 to 50 per cent overloaded, with consequent reduction of weight on the drivers, tending to produce a slippery engine. The excessive weight on trucks also increased the resistance to curving to such an extent that considerable damage to the track resulted. In other cases rough riding of fast passenger engines, after the application of one or more new springs, led to the discovery of differences of as much as 10 per cent between wheel loads on the same axle. With such examples as these in mind, it appears rather absurd to calculate counter-balancing and cross-balancing with meticulous accuracy, down to the last ounce and the precise angle, and then to give scant attention to the static weight distribution.

Wm. T. Hoecker.

A Desirable Characteristic Of the Unaflow

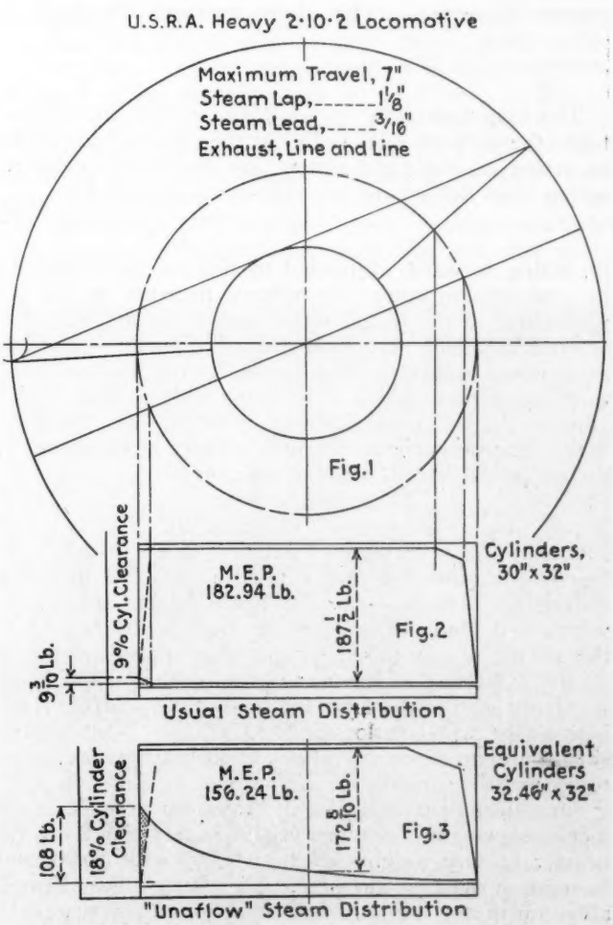
To the Editor:

In looking over reports of performance of Unaflow locomotives on the railways of Germany, Austria, Rumania and Russia the writer was very much impressed by the fact that in all the locomotives in which no provision was made for by-passing a portion of the compression when using the latest cut-off as at starting and on hard pulls for the purpose of increasing maximum tractive force, there was agreement to the effect that "engine ran quietly and without jar." This the writer took as referring to what we know as pounds or knocks in machinery bearings.

This seemed remarkable in view of the fact that most of the locomotives were reported to have been out of shops for some time and were, therefore, somewhat loose in driving boxes and rod bearings and also most of them had no adjustable driving-box wedges.

The heavier reciprocating parts of the Unaflow seemed conducive to the opposite effect, so it was concluded that the reason was to be found in the steam distribution. The practice of taking two indicator diagrams on one card does not seem to have been in vogue in the countries mentioned and the single cards revealed nothing, so cards showing two diagrams were constructed to bring out conditions found on combination.

The writer has chosen the U.S.R.A. 2-10-2 B locomotive for the purpose of comparison. Fig. 1 is a sweet valve event diagram. Fig. 2 is a constructed (theoretical) indicator diagram based upon events obtained from Fig 1. Fig. 3 is a constructed (theoretical) indicator diagram of Unaflow steam distribution, using events given in reports. To bring out the effect of combining the diagrams from the two ends of the cylinder, the writer has transferred the slanting exhaust lines



from the right to the left end of the diagrams, showing the same in dotted lines. This reveals in the Unaflow a rather large, approximately triangular area, shown by shading. This area is net negative work which is quite different from the negative work of back pressure seen

on a single diagram of one end of the cylinder. It starts at nil on the side from which the piston is advancing and gradually builds up to a pressure of 108 lb. at the time of admission opening.

The effect of this is to set up resistance to piston movement which increases gradually as the piston approaches the dead point. The result of this is that at some point between nil and maximum (108 lb.) the piston must stop or lag until the direction of pressure in the machinery bearings between the piston and the engine frame has been reversed and all journals will be thereby seated in the proper direction to receive the thrust of the admission steam. As this has been done by the application of a gradually increasing resistance, no shock can occur and the engine must run quietly. Inspection of Fig. 2, the usual steam distribution, reveals an area of negative work, but as it is microscopic it is of no value.

It is a fact well known to practical men that in locomotives with the right crank leading the left main driving box is usually first to give trouble from pounding. This is due to the fact that steam acting on the right piston causes reaction through the lever formed across the frames by the main crank pins and main axle in such a way as to hold the left main journal away from its proper seating in the box until it is seated by admission with a slam if slack exists.

In the locomotive under consideration the cylinders are 92 in. center to center and the frames are 41 in. center to center. The short arm of the lever is

$$\frac{(92-41)}{2} = 25\tfrac{1}{2} \text{ in.}$$

The long arm is 92 in. — 25½ = 66½ in. I have taken the pressure (187½ lb.) at the center of the stroke as acting on the right piston, say backward. The reaction from this on the left side is

$$\frac{187.5 \times 25.5}{66.5} = 71.89$$

lb. acting forward. Opposed to this we have only 9.3 lb. compression minus the exhaust pressure on the opposite side of the piston at the end of the stroke. It is at once apparent that no backward slipping of the left main wheel to take up slack in the driving box can occur until admission, when it is done with a slam which vibrates the entire locomotive. Now consider the Unaflow. The pressure in the right cylinder at the center of the stroke is 172.8 lb. and the reaction is

$$\frac{172.8 \times 25.5}{66.5} = 66.17 \text{ lb.}$$

Opposed to this we find a pressure of 108 lb. The difference (108 lb. — 66.17 lb. = 41.83 lb.) acts backwards and tends to seat the journal in the box. On the 30-in. piston this aggregates a total pressure of 29,567.95 lb. and is sufficient to produce the slight backward slip of the wheel needed to seat the journal in the box, as the wheel carries only 30,300 lb. When admission occurs no shock can follow, as all bearings are seated to receive the thrust.

An objection to Unaflow in American practice is the increased weight of the piston and its rod which involve heavier balance weights in the wheels, with consequent increase of dynamic augment. This is serious and probably constitutes the only real objection, as there can be none against the slightly longer wheel base required by the long cylinder.

Since the advent of heavy power the problems of maintenance are looming very large, the writer having knowledge of two instances where locomotives can not safely make more than 5,000 miles between drop-pit jobs to make repairs to driving boxes and rod bearings.

This is a very costly item which, with an allowance of loss of service, may run to $100 to $150 per day out of service. In making 100,000 miles between shoppings no less than nineteen such operations are necessary. If pounding in machinery bearings, even when loosened, can be eliminated, at least a portion of the drop-pit work can be dispensed with, probably two-thirds of it. This would mean appreciable savings.

It is the writer's opinion that arrangements can be made whereby the benefits of Unaflow in the matter of smooth running may be had in ordinary cylinders by change of steam distribution which will not cause a loss of more than 1¼ per cent of the original starting tractive force, at the same time showing some economy in the use of steam.

C. F. PRESCOTT.

Adaptability Counts

TO THE EDITOR:

A few years ago, I read with much interest a discussion on "The Reader's Page," having reference to the advisability of a mechanical-department foreman interesting himself in learning something about the workings of his fellow foremen of the different crafts. As I remember, there was only one foreman that was favorable to the idea that it would be a good plan to learn all that he could about the other fellow's job without neglecting his own.

At that time, and all my railroad life, I had been eager to learn as much as possible about anything pertaining to mechanical matters, and have found, since this depression, that I would, without a doubt, have been long since one of the vast army of unemployed had I not paid strict attention to every mechanical operation that I had opportunity to witness.

For a good many years prior to 1930, I had been the head of the car department on a Class I railroad, and had done no manual labor for approximately twenty years. About this time, our railroad changed hands, and then the depression struck, necessitating curtailing expenses. So my job was abolished and I was given the privilege of taking a division foreman's job at an outside point, with the understanding that, in the event that I failed to handle the job, that would be all for me.

The layout was: three switch engines and one local-freight engine to maintain between monthly inspection dates, and this against a bulletin that in the event that a Federal locomotive inspector issued a Form Five ticket against a locomotive, the officer in charge at that point would be summarily dismissed. Then, there were two open interchange tracks with another railroad, four miles apart, that must be covered, and I was the sole mechanic on duty from 3:00 A.M. to 7:00 P.M., and fifty-three years old!

The second day after taking charge, a switch engine tied up at 7:40 A.M. with three loose tires, and I must have this engine ready at 2:10 P.M.—and I had never set a tire in my life! However, I, with the aid of a colored engine watchman, had the engine ready on time, because I had seen it done and hadn't forgotten.

Since that time I have had plenty of harder jobs, and in the four years have had only one engine failure, no engines tied up by Federal inspectors, am still on the job, and like it.

"LANG SYNE."

With the

Car Foremen and Inspectors

Lubrication of Railroad Car Journals*

By I. T. Burney†

Practical suggestions on maintenance of packing and qualities of oils to keep hot boxes at a minimum

LUBRICATION consists of interposing a film of lubricant between the metals of a bearing. When the supply of lubricant is ample for the bearing needs there is actual separation of the parts, but when, for any reason, the supply falls off to the point where it is inadequate the metals come in contact and abrade or seize. The oil should be of a good grade and must meet service requirements as to viscosity, flash, fire and pour tests in order to obtain the proper results. Regardless of the grade of oil used the results are largely dependent on how well the men of the car department perform their part of this important task of lubrication.

During the past six years the railroads of this country have shown a wonderful improvement in the miles made per heating failure on both locomotives and cars. Only as far back as 1928 one was not ashamed to mention 40,000 miles per heating failure on freight cars and 100,000 in passenger service, but today heating failures on freight cars showing anything under 100,000 miles, are not mentioned in polite society, and passenger cars must wear the million-mile ticket to gain entrance. This great improvement has been brought about without material changes in the design of any part of the journal box and in the face of increased load per car as well as an increase in the train-miles per hour.

The A.R.A. Committee on Lubrication has adopted standard recommendations for car oils, both seasonal and year round, which, if followed, will furnish the railroads a good standard for quality in the purchase of these lubricants. Some of our roads do not fall in line with the "year round" oil recommendations, feeling that they are justified on account of local conditions.

Importance of Viscosity

In speaking of oils one frequently hears the term "viscosity" and it might be well to give an every-day idea as to what the word really means. The viscosity of an oil at any given temperature is the number of seconds required for 10 c.c. of the oil to pass through an orifice of a standard fixed size. To illustrate, the oil to be tested has been heated to 210 deg. F., and it requires 60 sec., by the stop-wach, for 10 c.c. of the oil to pass through the orifice. That oil is said to have a viscosity of 60 sec. at 210 deg. F. In the United States the standard appliance for viscosity determinations is called the "Saybolt Viscometer" and its findings are spoken of as being "Saybolt Universal".

I think I am safe in saying that the majority of our roads today are using car oils with viscosities ranging between 50 and 60 sec. at 210 deg. F., but some roads, particularly in the south, are still using oils running well into the sixties and, in some cases, going above that viscosity. Again, every once in a while we hear someone calling for an oil of 40 to 45 sec. at 210 F.

There are so many varying conditions to contend with in car-journal lubrication, over many of which no man has complete control, that it is befitting for us to have some reserve power in the viscosity of our oils, otherwise we may look for heating delays. I do not attribute your success in lubrication during the past few years

Miles per hot box have more than doubled in the past five years

* Abstract of a paper presented before a meeting of the Eastern Car Foreman's Association, April 28, 1934.

† Service engineer, Galena Oil Corporation. Formerly lubrication engineer, Boston & Maine, and member of A. R. A. Committee on Lubrication of Cars and Locomotives.

solely to the use of lighter oils, but would rather say that better oil in the boxes has been a large factor. Much of this better oil in the boxes has been brought about through improved renovation of the old oil and periodical repacking of journal boxes.

Improved finishing of car journals in the past few years has helped materially. Some roads grind their journals, others do a good job of rolling. This means better journals to lubricate. When it comes to the job of packing the boxes we are impressed with the advances made, for now we seldom see a box with the packing up against the lower edge of the brass, and the mouth of the box packed solid to keep the lid from rattling.

An oil to be satisfactory must have sufficient viscosity to hold the metals of the bearings apart, for where the oil film is thin heating takes place as the lubricant becomes less viscous, and when heavy loads are carried the metals touch and abrade each other. When an oil is of too low a viscosity and heat is generated, increasing the viscosity to a certain point will reduce the temperature, after which a further increase in viscosity does not result in decreased friction, as increasing the viscosity of an oil also increases the fluid friction and this will cause a rise in temperature. On the other hand, the sustaining power of a bearing is often increased by using a more viscous lubricant, notwithstanding the increased friction and resultant heating.

The A.R.A. Committee on Lubrication in its recommended specifications for car oils has been endeavoring every year to flatten out the viscosity curve, or, in other words, to lower the viscosity at 100 F., without a corresponding decrease in the seconds viscosity at 210 F. The flatter this viscosity curve can be made, other things being equal, the less fuel will be wasted in overcoming friction heat in the bearings. Loss of fuel in overcoming the friction caused by poor or unsuited lubricants applies to locomotives as well as to cars. The higher the temperature at which bearings run the greater will be the loss in fuel, as it requires coal to overcome the excessive friction which brings about the higher temperatures of bearings. If a bearing runs 30 deg. warmer with oil No. 1 than it does with oil No. 2, you will certainly burn more coal doing the same amount of work when using No. 1 oil than you would with oil No. 2. This applies to bearings lubricated with grease as well as with oil. In making tests of prospective lubricants it is always important to make temperature readings at the same time.

Application of Lubricant and Maintenance of Parts

So far, I have dealt principally with the lubricant; now I wish to get to another and most important part of our subject, that of the application of the lubricant and the maintenance of the parts involved.

The method of applying the lubricant remains the same as it has been for years, by the use of wool, cotton, or a mixture of both cotton and woolen packing as the carrying agent. We need not devote our time in discussing which one of these are best suited to the work, as all are permissible, but may confine ourselves to the statement that it should be of good grade, free of foreign matter and dirt and of as long strands as is practical within a reasonable price range. Packing which carries an excessive amount of lint is undesirable, as we frequently have heatings charged to waste grabs, which in reality were caused by an accumulation of lint on the loading side of the brass, so that when the journal brass was lifted from its bearing, due to shocks from striking standing cars or emergency application of the brakes, the rotation of the journal carried the lint up under the brass where, on the brass again seating itself, it was caught under the load. It has been claimed that the use of the light oils will overcome much of this trouble. I hope this proves true, but can see but little on which to base the hope. When we had the heavier oils, it was claimed that particles of waste saturated with the heavy oils would stick to the journal and be carried up under the brass and, with the use of the lighter oils, this ability to stick to the journal would be lessened to a noticeable degree and improved conditions would result.

Granting all these claims to be true, we have now reduced the possibility of strands of packing being carried to the brass by adhering to the journal, but what of the new conditions we have with us in the use of the light oils—that of these light oils readily being precipitated, leaving the top of the packing very dry? In fact, samples withdrawn from many of these boxes did not have oil enough in them to soil one's hands, and when this condition exists we are bound to have flying lint in the box and the journal action will carry it toward the brass.

The present standards in packing journal boxes should have some influence on the waste-grab situation, for if we keep our packing one inch below the center line of the journal we should not be so liable to have stray strands of packing ready to be caught under the brass at the first opportunity as was the case when the packing was always up against the edges of the brass. Keeping the packing down one inch below the center line will result in far better lubrication than with the higher packing in the boxes.

Another forward step was made when the use of the hard-wound back roll was made optional. Making the so-called "front plug" optional was a good move, and the sooner its use is ruled out the better off we will be. This packing in the front of the box did nothing but prevent a proper inspection and setting up of the packing aside from being an uncalled for waste of packing.

The general practice of applying new brasses at the time of new wheel applications has helped greatly in keeping down heatings after doing this work. When wheels are applied many serviceable brasses are removed and, if some practice is developed with which the full radius of the brasses so removed can be restored, there is no reason why such serviceable brasses cannot be again put back into use on home line cars and in this manner save quite a bill for new brasses.

Reversed Movement of Cars

Many roads are confronted with extensive reverse movements of heavy loads out of some of their terminals and it might be well to devote a little time to what can be done toward keeping down heatings on cars involved in such moves. I think all of us have had our troubles with cars of this class. The box conditions mentioned in the preceding paragraph have a strong influence on the performance of cars encountering reverse movements. A well packed car starts on a run of 200 miles, straightaway, and during this run the journal motion is in one direction, setting up the following box conditions: In passing over the packing the journal picks up a supply of oil, carrying it up to the point of load, where, when coming under the load area, the pressure forces a part of the oil off the journal. This excess oil is carried up by the journal, then falls from the loading side of the brass onto the warm packing, where it is quickly precipitated. When this car arrives at the end of the straightaway run we find the off or unloading side of the packing very dry, while the on or loading side is well saturated, but after standing a short time in warm weather the excess oil on the loading side will gradually fall away from the journal toward the bottom of the box, leaving the entire mass of the packing fairly dry. If this car continued in the straightaway move there would still be enough oil

left up in the packing on the loading side to take care of the journal for a considerable more mileage, but let's look at the condition when the movement is reversed.

The direction of journal rotation is now reversed; the well-saturated part of the packing which was the on or loading side now becomes the off or unloading side, and the dry packing which was the off or unloading side now becomes the important on or loading side of the bearing. The reverse movement in the rotation of the journal now causes the journal to leave the unloading side of the brass and immediately pass over the best saturated part of the packing, where it picks up its supply of oil, but, as it continues to move across the packing, it encounters the dry condition, of what was formerly the unloading side of the packing, where it gives up most of its oil to replenish the supply in the dry packing, thus passing along and coming under the load lacking ample oil with which to force a separation of the metals of the bearings. In order to keep down heatings on reverse movements it is essential to have the packing ironed properly.

Requirements for Good Results

Some roads resort to the use of free oil and in many cases it is needed, but this method of treating, while it requires fewer man-hours, is not to be compared to the proper servicing of boxes with the packing iron. I have always termed "free oiling" as being a "shot in the arm," for the reason that it will help out for a short mileage but over long distances is not adopted to good service. Most boxes have plenty of oil in the bottom waiting to be forced up through the packing by means of the iron and adding more oil to the top of the packing where it will soon precipitate and join the other at the bottom is not good practice and causes waste of lubricants.

To get good results from car lubrication there must be close co-operation between the car and operating departments in order that cars may be switched or humped and placed on the outgoing tracks as long before the departure of the trains as possible. Many operating officers

A shot of free oil can never take the place of proper servicing

are not conversant with lubricating conditions, therefore fail to see the difference between servicing boxes prior to, or after they have been switched or humped. I have had occasion to go into such matters and have been told it made no difference when servicing boxes as long as the work was done. If these officers will take time to inquire into this phase of the work, I feel sure they will see that it makes all the difference in the world in the running of the cars whether the boxes are worked just prior to leaving time or after their arrival and prior to their being made up into the train. I have frequently had a string of cars worked prior to their being switched, making a close check on the conditions found after the switching or humping had taken place. In practically every case I found the packing displaced and in no condition to start a long run.

Results from Switching

A few years ago one of our largest roads conducted some interesting and enlightening tests to determine just what effect heavy shocks to cars would have on brasses, wedges and packing. The method used to get the findings was to push an empty car at various speeds, allowing it to strike standing cuts and noting results. It was found that when this car, moving at a speed of 2 miles an hour, struck the standing cut the journal brass was raised ⅛ in. off the journal. Again, this same car moving at a speed of four miles an hour, striking the standing cut, lifted the brass ⅜ in. off the journal. At four miles an hour the packing was displaced to the extent that it touched the brass on one side. At six miles an hour bearing raised 17/32 in. and the packing started out of the mouth of the box. At 7¼ miles an hour the brass and wedge were displaced and a large part of the body of the packing was caught under the brass when it reseated itself. Dragging this car with the brakes set after one of the shocks caused the brass to raise from the journal. Emergency brake application at slow speed caused the brass to raise and the packing was caught, forming a waste grab. In citing the above facts I hope to make clear my point regarding the desirability to service the boxes after, instead of prior to, heavy switching movements.

Winter Troubles

During the summer months servicing journal boxes does not present the difficulties which are confronted when severe cold weather arrives. During the past winter, well, most of us would just as soon forget just what they found themselves up against. With temperatures ranging from zero to 50 deg. below we had "rolling packing" to add to the difficulties which are experienced at such times to keep the packing set up. It was not unusual to see cars moving past with the packing resembling small cabbages hanging from the mouths of the boxes and if the car reached the terminal without being set out, the next problem was to get this frozen mass of packing back into position in the box.

It is not necessary to recall further what you were up against. The thought in your mind at present is "Tell us what to do to overcome such a condition in the future." I wish I could give you a practical solution, but I cannot. Theoretically, the answer would appear to be "Keep the moisture out of your boxes and you will eliminate a large percentage of this trouble." But we know this cannot be done where cars are handled through the snow belts, for the flying snow will find its way past the best fitting dust guards and journal box lids, and moisture in the box is the result. With exceedingly low temperatures this moisture freezes the packing to a solid mass, and where the packing comes in contact with the journal

it seizes. Then, at the first movement of the journal, the whole mass follows the journal to the edge of the brass and when forced by the great pressure to break away it is forced out of the mouth of the box.

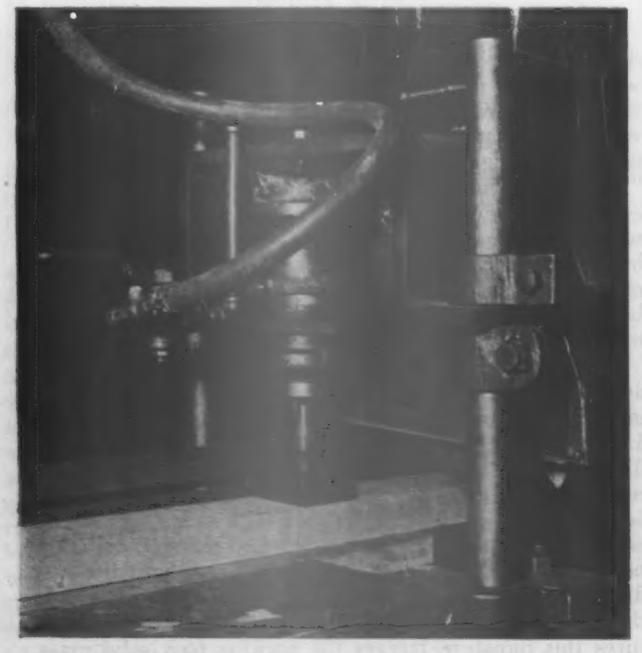
When boxes arrive at a terminal in cold weather there are always small particles of water collected about on top of the packing, due largely to the melting of the snow, and where possible to work the box immediately with a good iron, these particles of water gather and fall down through the packing to the bottom of the box out of reach of the journal and the moisture content of the packing is thus greatly reduced. At the same time the oil, still being warm, is easily forced back through the packing up against the journal, and in doing so forces a portion of the moisture farther from the journal. I found this procedure was limited to the care of passenger cars and this equipment, when so treated, did not roll the packing nearly as much when the train was again moved from the yard to the station.

Pneumatic Clamp for Car Tenoning Machine

TO provide a positive device to hold material on a car tenoning machine, the pneumatic clamp shown is used on the Chicago & North Western. The clamp is built of a piece of 4-in. wrought-iron pipe bored out and threaded on each end. Two pipe caps are used as pressure and non-pressure heads of this cylinder, the upper one being welded onto a square piece of iron ¾ in. by 6 in. by 6 in. This upper piece is tapped at each corner for ½-in. cap screws which run up through slots cut in the supporting iron. By means of the slots, the cylinder can be moved to any desired location on the table to accommodate the various widths of material run.

The non-pressure head of the cylinder has a guide sleeve welded on, through which the piston rod operates. A 4-in. cup leather is used on the piston, and the bottom of the piston rod is riveted onto a roughed-up casting to insure a better grip on the material. The air hose leading to this hold-down clamp is connected to the supply line with a union which is disconnected each time a job is completed. A check valve is also installed next to the control valve so that if the hoses should burst the air in the cylinder would be checked at least until the cut was completed. The control valve is a three-way valve, which admits air into the cylinder in one position and exhausts it in another position. A release spring in the cylinder brings the piston back up to the top of the cylinder.

The effectiveness of this hold-down clamp will be appreciated when it is realized that a pneumatic pressure of 90 lb. per sq. in., namely, that of the shop air line, is provided against the piston, thus assuring that the work will be held down firmly and safely. In addition, the ease of clamping and releasing the work is a valuable time- and labor-saving feature.



Pneumatic clamp applied to a car tenoning machine

Shaping Sill Steps

A SILL step bending device, or tool, developed and successfully used at the Boyles (Ala.) shops of the Louisville & Nashville, is shown in the illustration, being adapted to the making of 24 different types and sizes of sill steps.

This tool, as described in a recent issue of the L. & N. Employes' Magazine, is designed to be used in conjunction with a horizontal pneumatic press, operated by an 18-in. by 24-in. cylinder carrying 90-lb. maximum air pressure. A chart shows the size and length of stock required for the various shapes and the stock is placed in separate piles at the furnace with the shape number marked on one piece in each lot for identification by the heater and machine operator. The heater puts all pieces of one shape into the furnace and the machine operator makes his adjustments for this shape by first setting the part *D* to the required angle. If it happens to be a step which has an edge offset as the one shown at *A*, this is

Sill step bending device used at the Boyles (Ala.) shops of the L. & N.

done by dropping the tongue *D* through a slot in the plate and placing a ⅝-in. steel pin in the hole, which gets a bearing on the plate when the desired angle is obtained.

The operator then adjusts the tool for the length of the step. This is done by sliding the small plate *H* to a line marked on the large plate which has the shape numbers of the different steps stenciled on it. This eliminates the use of a blue print or measuring for lengths as the operator knows the particular shape of step that is being heated and arranges the die to line up with this shape number on the plate.

After the material has been heated, it is first placed across the plate in front of the tool at *E* and with the forward movement of the piston the step is bent in a U-shape and the necessary edge set is made by the pressure forcing the square roller *G* to conform to the angle previously set at *D*.

The step is then taken out and placed at *H* where a suitable strap shown at *K* holds it up to the proper height on the end. For the last operation, turning back the ends, it will be noted that die *C* is in the center of the step and the movement from this position both forward and backward bends both ends as the adjustment lugs shown at this point throw the ends down and square with the step at *A*.

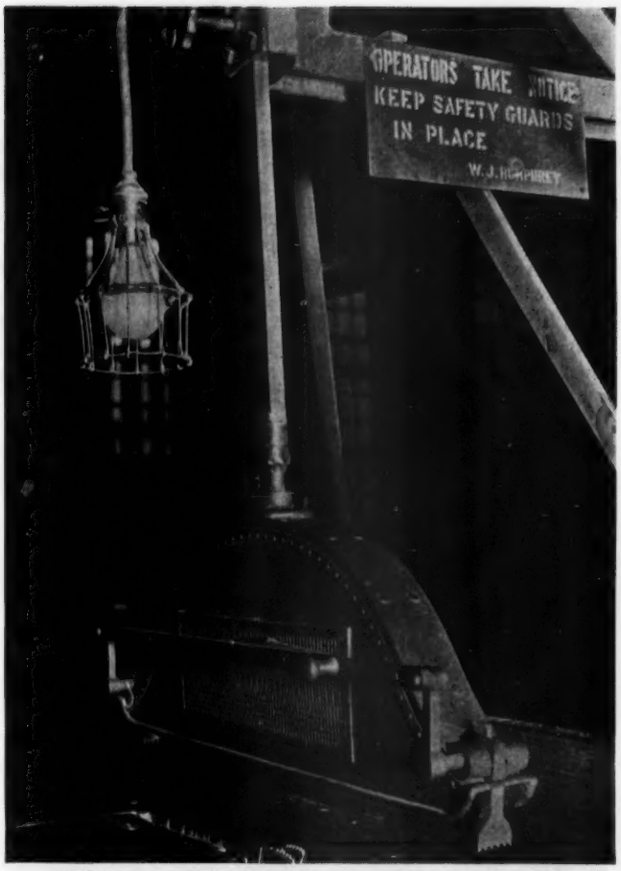
This die will make any step of the type shown at *A* from 8 in. to 16 in. in length with offsets ranging from a square step with no offset to one with a 5-in. offset.

Three Safety Devices At C. & N. W. Car Shops

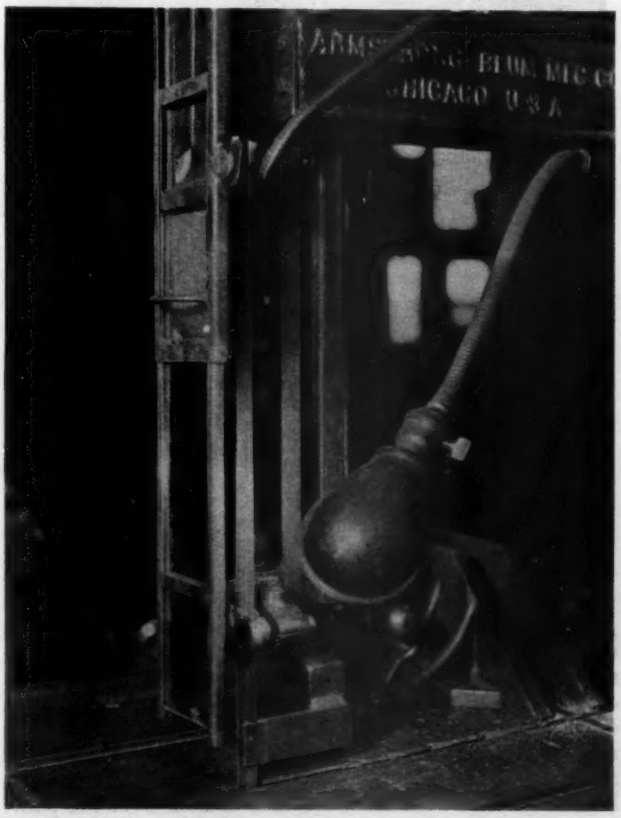
THREE safety devices which are saving time and labor as well as contributing to safety at the Chicago passenger-car shops of the Chicago & North Western are shown in the illustrations.

The first of these is a circular saw guard of the type used on hand-feed rip saws. The guard is built up of wrought iron, sheet iron, netting and steel. This guard has an up-and-down adjustment of about 20 in. and can be locked in any desired position by tightening the lock screw. This guard has both front and rear kick-back dogs and they work together. They are always returned to the position illustrated as soon as the material is through the saw. This action is brought about by a coil spring fastened to the connecting bar and to the main part of the guard. When material is to be run through the saw, the guard is set so the kick-back dogs are pointing ahead at about a 45-deg. angle. The teeth on these dogs are kept sharp at all times and they act to prevent a kick back, as the closer the dog is to a vertical position the less space is left between the table and the teeth. This causes the lumber to be wedged between the dogs and the table top and, in this way, it is locked.

The second illustration shows a safety guard of the type used for metal cutting band saws. It consists of an inner and outer frame made of 16-gage sheet steel joined by welding. The outer frame remains fixed and is secured to the top arm of the carriage by angles and bolts. The inside frame is equipped with ¼-in. plate glass 4 in. wide, and this frame can be set to the desired vertical adjustment by using a handle as provided and secured in position with a thumb screw threaded to the boss on the right side of the fixed frame. The range of adjustment is from ¼ in. to 15 in. above the table top. The distance between the glass and saw blade is 1-½ in. This guard has been found to be a very practical device in avoiding injuries particularly when cutting sheet-metal



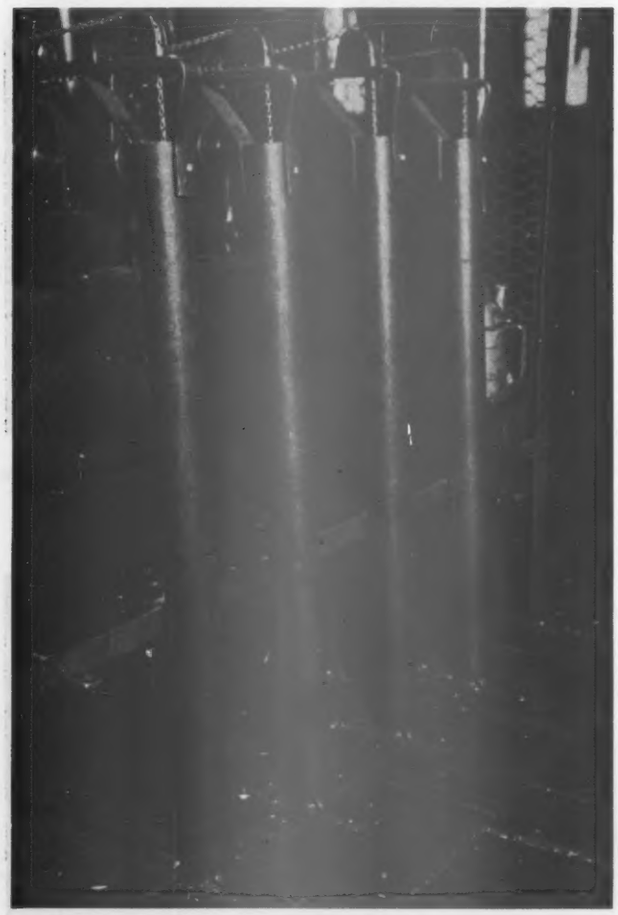
Circular saw guard used as a safety device to protect the machine operator



Safety guard as installed on a metal cutting band saw

parts which cannot be fastened down by clamping.

The third illustration shows a safety device applied to a four-spindle horizontal wood boring machine. Occasionally, one of the boring spindles works forward, due to the vibration of the machine and the device shown is designed to overcome that hazard. It is built of a piece of sash chain fastened to the rear end of the boring spindle and run back over a sash pulley and down into a piece of 2-in. iron pipe. A piece of 1½ in. diameter round iron about 7 in. long is attached to the other end of the sash chain. The pipe is held in a vertical position by splitting the base of pipe in four pieces and bending each piece out at a 90-deg. angle and lag screwing these ends to the floor. As soon as the operator releases his hold, the weight returns the spindle to starting position.



Safety device applied to a four-spindle horizontal wood boring machine

Metal-Covered Plywood

A LIGHT-WEIGHT metal-covered plywood, known as Armorply, is one of the new products of the United States Plywood Company, 103 Park avenue, New York. The plywood base is made up of a core of basswood, faced on each side with a thin sheet of Wisconsin birch. One or both sides may be covered with sheet metal. To meet different requirements the metal facing may be left extending beyond the plywood, bent over flush with the inner face or bent over the panel back with a lap 1 in. in width. Metal and wood are bonded together by a specially developed elastic glue.

For widths up to 36 in. the weights range from 1.46 lb. per sq. ft. for ¼ in. thick, faced with metal on one side, to 3.35 lb. for ¾ in. thick, faced with metal on two sides. Armorply is now available in sizes up to 80 in. by 190 in. Large size panels are made with a lock seam joint in the metal face.

Armorply may be faced with galvanized steel, Enduro stainless steel, Monel metal, chrome steels, copper, brass, etc. For special purposes it may also be combined with Celotex, Insulite, Balsa wood, or cork.

Due to its combination of light weight, great strength, long life and smooth, attractive surface, it has been found particularly useful as panelling for automotive trucks and trailers. In the railroad field it has also found a place in passenger-car construction, having been used on the Burlington high-speed, streamlined train, the Zephyr.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. R. A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Brake Beam No. 3 in Place of No. 2 Plus—Rules 17 and 87

The Chicago, Rock Island & Pacific removed a No. 2 plus brake beam with broken support rod from a Great Northern car and replaced it with a No. 3 brake beam, rendering a charge of $3.50 and one hour labor on repair card. Defect card was not issued. Owners contended that such substitution constitutes improper repairs for which defect card should be issued and requested cancellation of entire charge. Being unable to arrive at a settlement, the case was submitted by mutual consent for decision. The Great Northern stated that the car referred to was stencilled for and actually was equipped with No. 2 plus brake beams. Reference was made to Rule 17, Section (e), paragraph 1, and contention made that brake beams must be replaced in kind. Reference was also made to third paragraph of Rule 87 which requires repairing line to attach a defect card for making improper repairs of owner's defects, or assume entire cost of such repairs by marking repair card "no bill." Cancellation of charges was asked for under Rule 87, paragraph 4, and Arbitration Case 1706 was quoted as parallel. The C.R.I. & P. stated that at the time repairs were made they did not have any No. 2 plus brake beams on hand and, in order not to make wrong repairs and apply brake beam of a class lower, a No. 3 brake beam was applied and charge confined to price of No. 2 plus brake beam. No defect card was applied, as it was not considered that a wrong repair had been made by substituting a No. 3 for a No. 2 plus beam, both being interchangeable and A.R.A. standards.

In decision rendered October 26, 1933, the Arbitration Committee stated: "The brake beam applied fulfilled the minimum dimensions for a No. 2 plus beam, as given in Rule 101, and charge was confined to cost of beam standard to car. Therefore, the contention of car owner is not sustained."—*Case No. 1736, Great Northern vs. C. R. I. & P.*

In the Back Shop and Enginehouse

Building Up Worn Main-Rod Front Ends

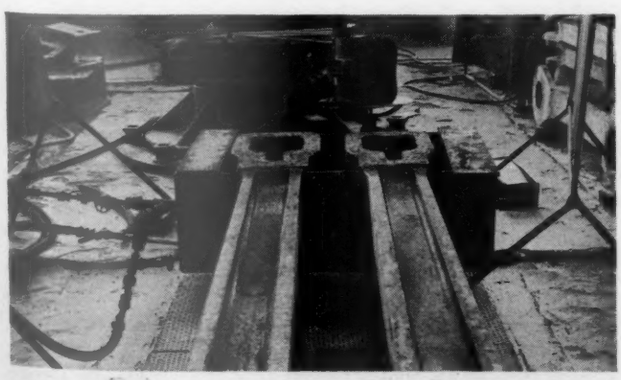
WHEN the sides of main-rod front ends become galled or badly worn, they are built up on the Illinois Central by the use of the electric process, a definite, carefully-developed procedure being followed to assure obtaining the desired results. As a matter of fact, this process has been followed at the Paducah, Ky., shops for a period of nearly two years and made possible a greatly increased service life of main rods without a failure of any kind.

The first operation consists of grinding the worn parts and the sides to be welded until all surface defects, checks and fractures are removed. The sides of the main-rod front ends are then etched with acid and carefully inspected by the engineer of tests, using a powerful magnifying glass, to make sure that all surface defects are removed. The formal approval of the engineer of tests is required before further reclamation work on the main rods is done.

The second operation consists of slowly preheating the rod ends to be welded in a charcoal furnace where the required temperature is maintained during the time of welding. Referring to the illustration, this furnace consists of a simple, rectangular, sheet-metal design, lined with fire brick and provided with connections to the shop air line for blowing purposes. The rods are usually welded, two at a time, the ends being inserted in the furnace at one side which is cut away to receive and support them flush with the top of the furnace. Cover plates are used at the ends and between the rods, not only to retain the heat but to serve as a protection to the welders. Portable vertical shields surround the furnace during the electric-welding operation as a protection to workmen employed in the immediate vicinity. A temperature of 600 to 800 deg. F. is maintained in this preheating furnace for all types of rods welded.

Both low-carbon and chrome-vanadium steel rods are reclaimed by this method, Hollop No. 250 shielded arc electrodes being used in the former case and No. 170-E electrodes in the latter case. Each layer of the welded material is thoroughly cleaned by chipping and sandblasting before application of a subsequent layer, and the operation is continued until the welding surface is ⅛ in. above the finished size. The rod ends are then heated to a temperature of 1,600 deg. F. in a pyrometer-equipped furnace, placed on a face plate and a heavy hand hammer and flatter used to smooth and pack the welded surface, after which it is ground and inspected for flaws.

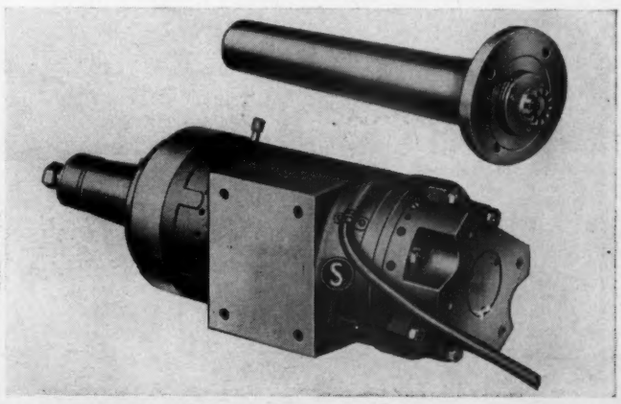
The rods are then placed on the table plate of another pyrometer-equipped heat-treating furnace for heat treatment, supported properly to prevent warping and, in the case of carbon steel rods, the furnace and rod temperature raised to 1,550 deg. F. The rods are then allowed to cool down in the furnace to 1,300 deg. F., being removed at that temperature and allowed to cool in the open air. In the case of the chrome-vanadium rods, they are heated to a temperature of 1,525 deg. F., removed from the furnace and cooled in the open air, then being returned to the furnace and heated to a temperature of 1,200 deg. F., after which they are cooled in the furnace to 800 deg. F. and finally cooled to atmospheric temperature in the open air. A final inspection and check for alinement is made before the rods are sent to the machine shop for fitting up.



Charcoal furnace used in preheating main-rod front ends prior to building up worn side faces by electric welding

Combination Angle Plate Grinder

THE Standard Electrical Tool Company, 1938 West Eighth street, Cincinnati, Ohio, has developed a new combination angle plate grinder. This machine is powered by a General Electric 3,600-r.p.m. alternating-current motor which may be of 3, 5 or 7½ hp. size. The motor shaft is fitted with two S K F ball bearings, while the grinding wheel spindle is equipped with three S K F ball bearings, two of them being located at the wheel end to take care of the end thrust. It can be furnished with solid spindle or with clutch arrangement so that the



This standard combination grinder is provided with attachment pads on side and end

short extension is interchangeable with the longer extension. It may also be obtained with vertical, or horizontal, or with both vertical and horizontal feeds. This is a versatile machine, as the pad on the back of the motor may be used for mounting on a boring mill, while the pad on the side of the motor housing is arranged for mounting on the rail of a planer. It can also be fitted with a plain angle plate for attaching to a lathe.

No. 2 High-Speed Turret Lathe

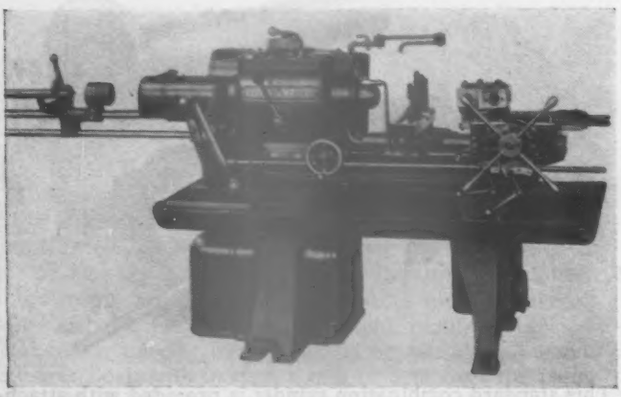
A NEW 1-in. bar capacity turret lathe capable of 1,480 r.p.m. and with an improved bar-feed mechanism is announced by The Warner & Swasey Company, Cleveland, Ohio. This turret lathe is equipped with a six-speed all-geared head with speed ranges from 67 to 740 r.p.m. up to from 134 to 1,480 r.p.m. A two-speed motor makes 12 speeds possible with a range from 67 to 1,480 r.p.m.

The entire head is anti-friction bearing equipped. All gears are of hardened alloy steel and have ground teeth for silent operation. The head has sufficient power for heavy-duty work with cemented tungsten carbide tools. A single pulley constant-speed drive makes the full horsepower available at all six speeds. The forward and reverse multiple disc-clutch has ample area to allow reversing even at high speeds. A four-to-one ratio high-low clutch makes possible the instant shifting from turning to threading or reaming speeds, or vice versa, without stopping the spindle. Lubrication of the entire head is by splash system. The spindle is mounted on double row precision Timken bearings at the front end and a preloaded precision straight-roller bearing in the rear. All other shafts run on roller bearings.

The new type automatic circumference binder ring, which permits the clamping and indexing of the hexagon turret by a rotation of the turnstile, is incorporated in this turret lathe. This is valuable in high-speed work where the reduction of the handling time becomes an item.

The high speeds and ease of operation make the turret lathe an efficient tool for very small work or for second-operation work. Cemented tungsten carbide tools may be used on cast iron, steel, non-ferrous metals or non-metallic materials.

A new combination friction finger and ratchet bar feed has been designed which speeds up the operation and provides for the safety of the operator. Bars up to 5/8-in. diameter are advanced with a friction finger lying immediately behind the collet inside the spindle and enclosed throughout their length. This prevents buckling or bending of the bar through centrifugal force, and thus protects the operator and eliminates vibration. The use of filler tubes assures balance at high speed by centering the bar in the spindle.



Warner & Swasey No. 2 six-speed turret lathe

Bars above 5/8-in. diameter are fully enclosed at the rear end, being exposed only for the length of the ratchet feed stroke between the spindle end and the bar support tube. There is, of course, no danger of buckling in bars of this size when supported at both ends. By using the ratchet feed for the larger bars, it is possible to have a maximum 1-in. capacity with a spindle small enough in diameter to stand extremely high speeds.

Another feature of this machine lies in the possibility of arranging the cross slide as a lever feed or screw feed type, or a combination of the two, by simply substituting the required parts in the cross slide. The power feed is new and has been designed for continuous operation at high speeds. The initial reduction from the spindle is by V-belt. The first reduction gear, made of hardened alloy steel, has ground teeth to insure silent operation. The entire train is mounted on antifriction bearings and all apron gears are of hardened alloy steel. Lubrication is by grease, which cannot be readily washed away by the coolant. The pressure used to force grease into the bearing tends, at the same time, to force out foreign matter. The hardened worm runs in an oil bath and is completely shielded to prevent oil loss by centrifugal force. The six feeds for the hexagon turret range from .003 in. to .030 in. An option of two change gears will reduce the feeds by one-half.

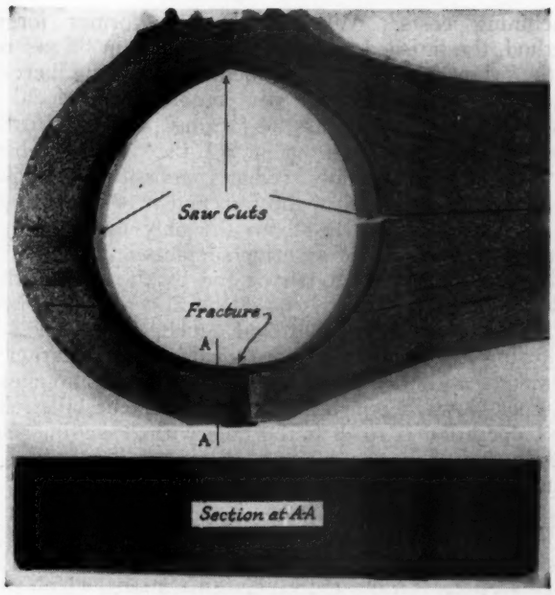
Forging Main-Rod Back Ends

IN studying the failures of locomotive main and side rods, it has been found in certain cases, particularly in failures of main-rod back ends, that the fractures (or breaks) occur at points where the work-flow lines or crystal forms in the steel lie at right angles to the axis of the rod proper. Expressed in another way, the service stresses are exerted in a direction in which the steel is least able to support such stresses, especially from a shock-resisting standpoint. It is generally recognized that the weakest direction in a forging or rolled section is transverse to the direction of maximum forging work; that is, there are decidedly lower physical characteristics in the transverse direction, including reduced tensile strength and especially ductility, as indicated by lower elongation and reduction of area and by lower shock resistance, as shown by Izod and Charpy tests.

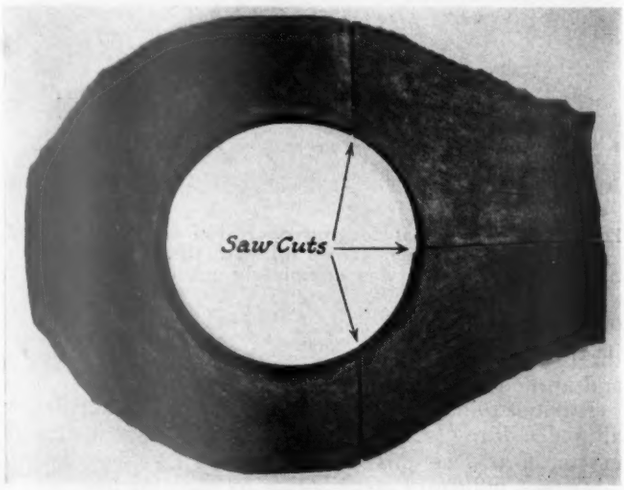
With the object of reducing the number of failures of this type, the Chicago, Rock Island & Pacific has worked out an improved method of forging rods, whereby the most advantageous disposition of the work-flow lines is attained and proper forging work provided throughout all sections of the rods. It has been general practice on this road, as well as on other roads and by forging companies, to use large size billets for main rods, such as 12 in. by 20 in. or 12 in. by 22 in., it being considered necessary under the ordinary forging practice to use this large size billet in order to make the large diameter back end, necessary since the floating bushing came into general use. This back end, using the large

billet, is forged solid and the crank pin hole cut out by machine or with a gas-cutting torch. Even starting with these large size billets, due to the large diameter of the back ends, very little reduction (in some cases, practically none) takes place across the vertical diameter, and, in consequence of this low reduction, proper forging work does not occur in the top and bottom sections and, in some cases, at the end of the rod. Another feature is that after forming the back end, using the large size billet, it is then necessary to reduce this section (240 sq. in.) to a cross-sectional area of approximately 20 sq. in. for a length of 9 to 11 ft. up to the front end of the rod.

To obtain a more advantageous disposition of the work-flow lines and also to reduce the necessity of drawing out such long lengths of large cross-section billets, the method to be described was developed which permits using billets of smaller cross section, such as 10 in. by 10 in., or smaller. These can be purchased at a lower base price and, even more important, a superior grade of steel is secured. For example, the common requirement in steel specifications that there be a minimum reduction of 3 to 1 or 4 to 1 from ingot cross section to billet cross section means that the steel maker is forged to start with a large ingot. Where smaller billets are required, the initial ingot can be smaller. This, in general, produces sounder, more dense steel, relatively freer from massive crystal forms, especially in the columnar zone and also freer of internal defects, such as unwelded gas pockets and non-metal inclusions locally segregated.



Deeply etched longitudinal and cross sections of failed main rod—Weakness indicated by the transverse direction of work-flow lines at the section where failure occurred



Moderately etched section of main-rod back end, forged by the improved method, which produces work-flow lines so placed as to contribute to maximum strength and reliability in the forging

The method of manufacturing main rods now followed at the Silvis (Ill.) shops of the Rock Island consists of punching and drifting the pin hole, forming the head in dies, and thus obtaining the best direction of the work-flow lines to resist service stresses at all points around the pin hole. In addition to other advantages, a substantial saving is brought about through less scrap material involved by making the rods from the smaller blooms, less scale loss due to heating smaller blooms, less loss in actual metal machined off, and, further, lower

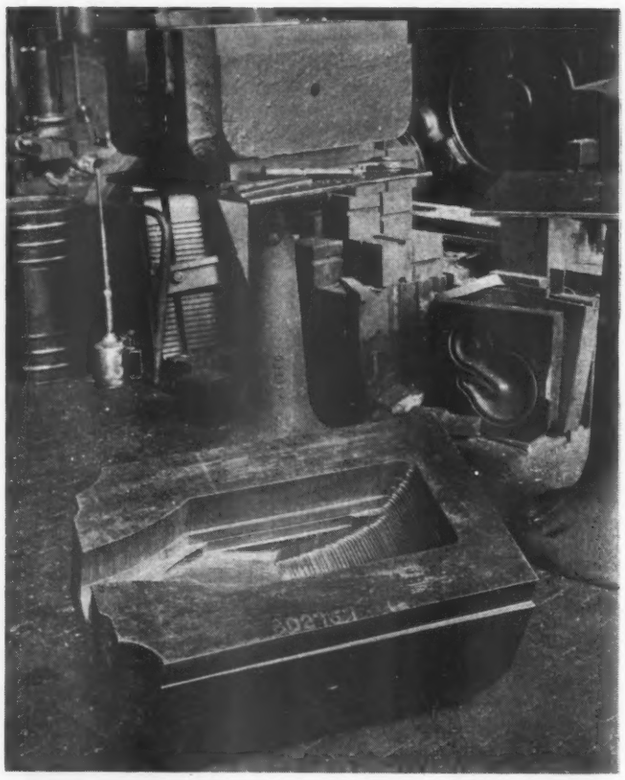
Main rods with back ends forged by piercing and drifting the pin holes to produce improved work-flow lines

machining costs. Whereas, by the former forging method, the finished rod weighed only about 35 per cent of the original billet, the new method of forging increases this to at least 50 or 60 per cent, and additional increases are anticipated as the forging process is further developed. As regards machining, the use of the head-forming dies materially reduces subsequent machine work on the back end of the rod, and it is felt that ultimately grinding will be about the only finishing operation necessary on the exterior surfaces.

In forging a main-rod back end by the new method, a 10-in. by 10-in. billet is used, the first operation being to pierce the head with an oval punch, 2 in. by 4½ in., following up with two more oval punches, larger in diameter, and then working the head to contour with hammer blows, a punch being inserted in the billet. The next operation is to drift the hole with one 9-in. round punch with hammer blows, followed by one 10½-in. round punch in the billet. The rod head is then finally shaped in the forming dies.

That the desired results are obtained in respect to the disposition of work-flow lines and more uniform working of all sections is indicated in the illustrations, which show deep etches of faces of vertical longitudinal cuts through the back ends of two main rods. A deep etch of a rod forged by former methods from a large-size bloom is shown in one of the illustrations. It will be noted that the work-flow lines run parallel in some sections to the axis of the rod but, at the top and bottom, the flow lines or crystal forms stand at an angle or perpendicular to the axis of the rod. This is the real reason that the rod failed in service, although it is true that the failure took place through the keeper bolt hole. It is conceded that improper location of this hole and improper workmanship in making the hole would be a factor in initiating a break at this point. However, in Rock Island experience, no breakage has occurred through this hole where the direction of the work-flow lines or crystal forms have been properly placed in respect to the direction of service stresses. An etch of a cross section at *AA* adjacent to this hole plainly shows crystal forms remaining in the same direction in which they froze in the ingot, the subsequent reduction by forging being not sufficient to displace these crystal forms and change the direction to form proper work-flow lines.

A representative etch of a rod made from the smaller billet by the improved method with the pin hole formed by piercing and drifting is shown in another illustration. It will be noted that a more uniform working took place through all sections and the work-flow lines run up to and around the crank pin hole.



Die used in the final forging operation on the main-rod back ends—View shows die in the tool-room before it was completely machined

It is not to be inferred that the Rock Island attributes all rod failures to improper direction of flow lines and crystal forms, as this is conceded to be only one of numerous influences contributing to such failures. It is felt, however, that if this factor is eliminated, the situation is improved to that extent, and by giving proper attention to providing generous fillets and rounded corners, assuring the proper location of oil and keeper bolt holes, eliminating all nicks and surface defects in so far as practicable, and smoothly polishing all surfaces, the service life is increased and liability of failure minimized.

Elliptic piercing and round punches for forming crank-pin holes—Used in the order indicated from right to left

Making Boiler Front Rings and Doors

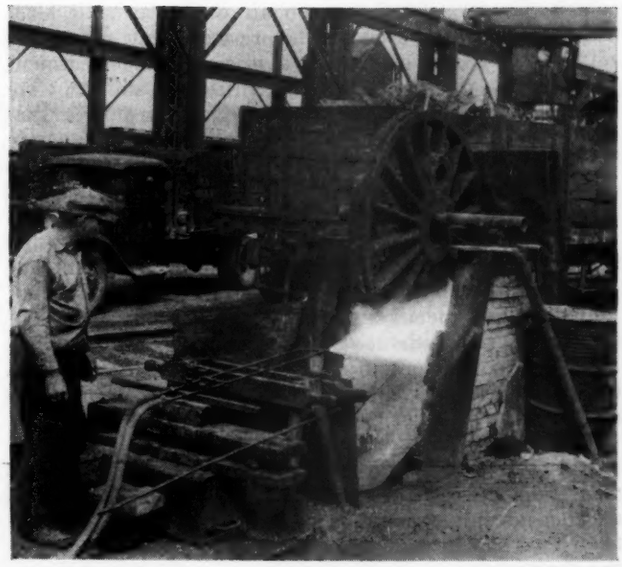
SOME difficulty has been experienced on the Illinois Central as well as other roads with cinder-cut boiler front rings and doors which wear thin and do not have the desired rigidity and length of service life. To meet this condition, it was decided on the I. C. to increase the thickness of these parts from ⅜ in. to ½ in.

In making the heavier front rings and doors at the Paducah (Ky.) shop of the Illinois Central, ½-in. steel sheets of the desired size are cut to shape and formed in the Southwark 2,100-ton flanging press, illustrated. In the case of the boiler front rings, the circular door opening is cutout with an oxyacetylene torch and the ring formed hot in one operation of the flanging press. The front-end doors are also formed to the shape indicated and flanged in one operation of the press.

Southwark 2,100-ton flanging press used at Paducah shops for forming boiler front rings and doors

Removing Babbitt From Driving Wheels

A CONVENIENT and efficient method of removing babbitt from locomotive driving wheels before they are disposed of as scrap is shown in the illustration. It consists of two 2-in. by 10-in. channels formed to an A-shape, with the flanges extending inward to serve as a guide for the fire brick which are inserted and form the sides of the furnace. A diagonal side brace, consisting of a piece of steel tubing welded to the upper side of each A-frame and firmly anchored in the ground at the lower end, serves to stiffen the frame and add



Convenient method of removing babbitt from driving-wheel centers

rigidity to the structure. The flattened upper end of each A-frame serves as a support for a double roller truck side bearing which, in turn, supports a short horizontal tube provided to carry the wheel center. This tube is inserted through the axle fit of the wheel center and enables the wheel to be revolved easily, as required, in heating various sections of the counterweight and rim for melting out the babbitt.

In heating the wheel center, a special distillate oil-burning torch is used, as shown in the illustration. The flame is directed against the lower part of the driving-wheel rim where it extends down between the A-frames. As the babbitt melts out of the wheel, it falls onto a curved steel sheet which guides it into a suitable receptacle, or mold. The amount of babbitt removed varies, of course, with the size and type of wheel center, but averages about 700 lb. per wheel.

Metal Coating To Prevent Corrosion

SEVERAL years ago in an effort to reduce replacements and maintenance costs on metal parts the Western Union Telegraph Company tried to find some method of protection against corrosion which would be more permanent than that provided by paint or lacquer alone. In furtherance of this effort Dr. Leo P. Curtin, consulting chemist, was delegated to make a study of this problem.

As a result of this investigation there was developed a metal treatment that is simple to handle, inexpensive and positive in its action. The ingredients consist of a powder and a solvent used in water at a temperature of approximately 150 deg. F. This metal treatment has recently been made available to the trade under the name of "Loxal."

The treatment consists of dipping the metal parts to be treated into a solution made up of about 10 oz. of Loxal powder and 3 oz. of Loxal solvent per gallon of water. The parts to be treated are introduced into this solution in perforated iron baskets, racks or trays, and are held in this solution for a period of from one to five minutes and are then given a quick rinse in hot water, after

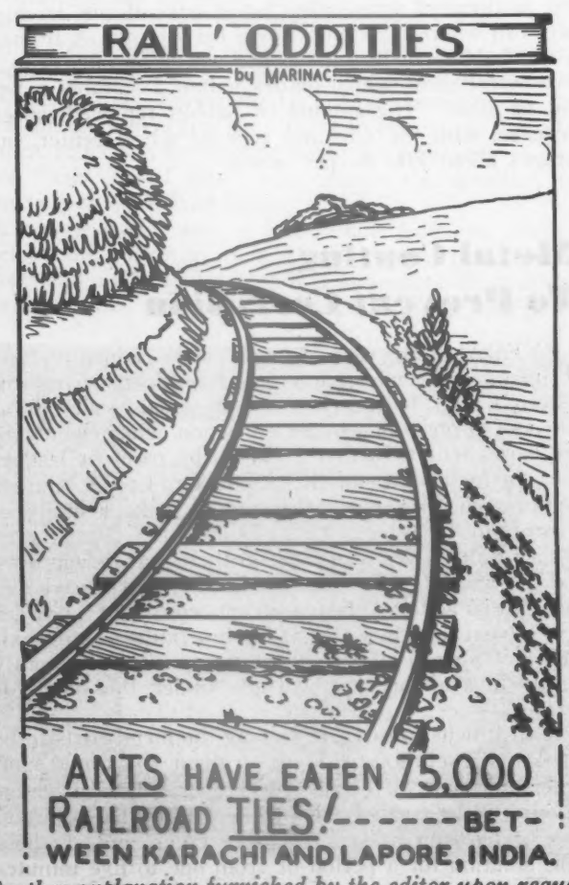
which they are dried in open air or a warm air blast. Little preparation is needed before treatment. Removing oil or grease and sometimes a brief pickling treatment, followed by rinsing in hot water usually suffices. The equipment required is inexpensive and requires practically no maintenance. A metal tank of requisite size, fitted with steam coils to heat the solution to 150 deg. F. and with facilities for filling with water and for handling the material to be treated, is all that is necessary.

Iron and steel parts, cleaned by ordinary materials, are extremely susceptible to rusting after treatment and must be lacquered or otherwise finished within a few hours. When metals are coated with Loxal, such parts may be stored without danger of rusting, until used or until it is convenient to apply the finishing coat. Loxal coating also acts as a bonding coat, to which the finishing coat of paint, lacquer or enamel tenaciously adheres.

It is applicable to practically all types of iron and steel surfaces. The carbon content of the steel has no appreciable effect in retarding the formation of the coating, and excellent results have been obtained on objects which have been spot-welded or which carry an oxidized film on the surface.

There is a large coverage per pound of material and no appreciable loss as a result of precipitated sludge in the work-tank, since the addition of Loxal solvent to the bath converts any sludge into a clear solution which automatically becomes the active coating ingredient. Iron equipment is not harmed by Loxal, and there is no danger of leaks occurring in iron tanks in which it is used. As no chemical incrustation forms on the heating coils, whether made of iron or brass, high heating efficiency is maintained.

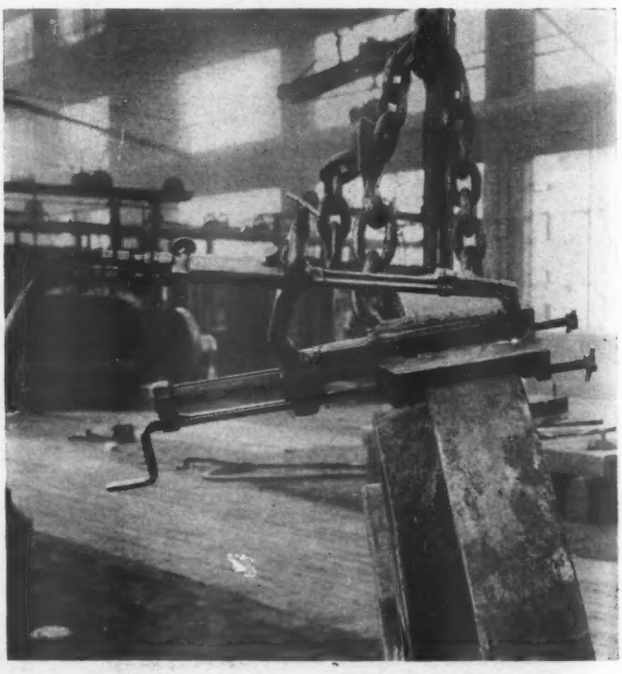
The material for this new process is being distributed by the Curtin-Howe Corporation, New York.



Further explanation furnished by the editor upon request.

Torch Guide for Cutting Wheel Rims

IN welding cast steel wheel centers with broken spokes, it is considered good practice to cut the wheel rims at one or more places to prevent the development of excessive internal stress due to expansion and contraction. In performing this operation at the Paducah (Ky.) shops of the Illinois Central an ordinary oxyacetylene cutting torch is used, being held in the simple guiding device, illustrated, to assure making a cut square across the rim of the wheel and in a radial direction. This device consists of a double-bar type bracket, capable of being secured to the rim of the wheel by hand screws and provided with a torch-holding fixture which moves back and forth over a suitable guiding bar under the control of a hand screw. This permits feeding the torch, with the point supported at the proper angle, slowly across the wheel rim. The general principle of the construction of the device is clearly indicated in the illustration.



Torch-holding fixture for use in cutting wheel-center rims prior to welding broken spokes

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RAILWAY NICKNAMES.—From all over the country they come, the railway nicknames. Culled from some 50 letters received are the following:

Lake Erie & Western	Leave Early & Walk
Zanesville & Western	Zealous & Willing
Toronto, Hamilton & Buffalo	To Hell & Back
Susquehanna, Bloomsbury & Berwick	Sweet Bye & Bye
Cincinnati, Hamilton & Dayton	Charges High & Damned Rough Riding
Hoosac Tunnel & Wilmington	Hoot, Toot & Whistle
Hoosac Tunnel & Wilmington	Hot, Tired & Weary
Live Oak, Perry & Gulf	Lean Over, Push & Grunt
Live Oak, Perry & Gulf	Live On Peas & Grits
Manchester, Dorset & Granville	Mud, Dirt & Gravel
Baltimore & Ohio	Best & Only
Green Bay & Western	Grab Baggage & Walk

Among the Clubs and Associations

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—Draft Gears and Snubbers will be discussed by a representative of the Cardwell-Westinghouse Company at the meeting of the Club on the morning of November 15 at the Ansley Hotel, Atlanta, Ga. Election of officers will also take place.

INTERNATIONAL ACETYLENE ASSOCIATION.—The thirty-fifth annual convention of the Association will be held at the William Penn Hotel, Pittsburgh, Pa., November 14, 15 and 16. At a transportation session on Friday morning, November 16, G. O. Hoglund, supervisor of welding, Aluminum Company of America, will present a paper on Construction of Transportation Vehicles by Welding. Another paper on the Maintenance of Railroad Rolling Stock will be presented by D. C. Reid, general superintendent of motive power, Boston & Maine. Other papers to be presented during the convention will discuss oxy-acetylene cutting with particular reference to steel mill applications; metallurgical aspects of the oxy-acetylene process; pipe welding and testing, and education and safety in welding.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—The annual meeting held on October 8 at The La Salle hotel, Chicago, was presided over by President F. L. Kartheiser, mechanical inspector, Chicago, Burlington & Quincy, who reported 800 membership renewals and the addition of 1,400 new members during the past year, bringing the present membership of the association up to 2,604 as of September 30. ¶ Immediately after the business session, the following officers were elected for the ensuing year: President, E. U. Mazurette, car foreman, Grand Trunk Western; first vice-president, C. O. Young, chief clerk to superintendent of car department, Illinois Central; second vice-president, J. S. Acworth, supervisor of equipment, General American Car Company. C. J. Nelson, superintendent of interchange, The Chicago Car Interchange Bureau, and G. K. Oliver, assistant passenger car foreman, Baltimore & Ohio Chicago Terminal, were re-elected treasurer and secretary, respectively.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The Railroad Division of the Society will hold two sessions at the annual meeting which will be held at the Engineering Societies building, 29 West Thirty-Ninth street, New York, December 3-7. The first session of the Division will be at 9:30 a.m., Tuesday, December 4, when two papers will be presented—Tractive Power of Steam Locomotives (Locomotive Ratios, II), by A. I. Lipetz, consulting engineer, American Locomotive Company, and Locomotive Tractive Effort in Relation to Speed and Steam Supply, by E. J. Young, research professor, Railway Mechanical Engineering, University of Illinois, and C. P. Pei, New York Air Brake Company. The second session will be at 2 p.m. on the same day when the papers for discussion will be Draft Gear Action in Long Trains, by O. R. Wikander, mechanical engineer, Ring Spring Department, Edgewater Steel Company, and Development of Steel for Application to Railroad Equipment, by A. F. Stuebing, railroad mechanical engineer, United States Steel Corporation. A progress report on railway mechanical engineering during 1934 will also be presented at one of these sessions by a committee of the Railroad Division.

WESTERN RAILWAY CLUB.—The first fall meeting of the Club was held at the Hotel Sherman, Chicago, Monday evening, October 15, over 300 members and guests being present to hear the paper on "Rail Transportation Problems and Solutions," presented by W. F. Thiehoff, general manager, C., B. & Q. Calling attention to the reduction in Class I railway operating revenues of 50 per cent from 1929 to 1933 and the reduction of over 65 per cent in expenditures for materials and supplies during the same period, Mr. Thiehoff said that, while the general recession in business has undoubtedly had its effect, the primary cause of the reductions mentioned is the increased use of private automobiles, motor buses, trucks, airplanes, waterways and pipe lines. ¶ In connection with the question of regulating non-rail transportation media, Mr. Thiehoff said: "These forms of transportation, developed during recent years, are not subjected to regulation as to rates, schedules, etc., as are the railroads. They have no investment in right-of-way, tracks, bridges, etc., pay taxes only on the value of equipment owned and on such terminal facilities as are owned by the operating companies. They do not pay the so-called standard wages under contract as do the railroads; are not subject to the same hours-of-service laws, safety laws, or rulings of the Interstate Commerce Commission; in fact, the owner or operator of a truck or bus may operate on the streets and highways subject to no restriction except the laws and rulings that apply to individuals. There can be 100 trucks or buses operated by as many owners as individuals if permit is obtained and license procured, each having a different rate. Even though operated over competitive routes and different states, they are not required to file tariffs, rates or schedules with the Interstate Commerce Commission." ¶ In discussion subsequent to the presentation of Mr. Thiehoff's paper, a number of members emphasized the need for constructive regulation of all forms of transportation, and the consensus was that little real permanent improvement in railway conditions can be expected until this regulation is initiated and made effective.

Directory

The following list gives names of Secretaries, dates of next regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, c/o Westinghouse Air Brake Company, Thirty-fourth floor, Empire State Bldg., New York. 1935 meeting tentatively planned for May 2 to 4, inclusive, Hotel Sherman, Chicago.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY ASSOCIATION.—Division V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASE AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION I.—SAFETY SECTION.—J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H streets, N. W., Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York. Annual meeting December 3-7, Engineering Societies building, New York.

RAILROAD DIVISION.—Marion B. Richardson, Room 332, 30 Church street, New York.

MACHINE SHOP PRACTICE DIVISION.—R. E. W. Harrison, 6373 Beechmont avenue, Mt. Washington, Cincinnati, Ohio.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—Edgar J. Kates, 1350 Broadway, New York.

FUELS DIVISION.—W. G. Christy, Department of Health Regulation, Court House, Jersey City, N. J.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreucetti, C. & N. W., 1519 Daily News Building, 400 W. Madison St., Chicago, Ill. Annual meeting, October 4-5, 1934, Hotel Sherman, Chicago, Ill. Exhibit by Railway Electrical Supply Manufacturers' Association.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago, 7926 South Morgan street, Chicago. 1935 meeting tentatively planned for May 2 to 4, inclusive, Hotel Sherman, Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-fifth street, Chicago. Regular meetings, second Monday in each month except June, July and August, La Salle Hotel, Chicago, Ill.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month except June, July and August at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings, fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—R. A. Singleton, 822 Big Four building, Indianapolis, Ind. Regular meetings first Monday of each month, except July, August and September, at Hotel Severin, Indianapolis, at 7 p. m.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—T. D. Smith, 1660 Old Colony building, Chicago. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha street, Winona, Minn. 1935 meeting tentatively planned for May 2 to 4, inclusive, Hotel Sherman, Chicago.

MASTER BOILERMAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meeting first Monday each month, except June, July and August, at Minnesota Transfer Y. M. C. A. Gymnasium building, St. Paul.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CLUB OF GREENVILLE.—Ralph D. Stewart, 21 Sherrard avenue, Greenville, Pa Regular meeting third Thursday in month except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1941 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION.—E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

TORONTO RAILWAY CLUB.—N. A. Walford, district supervisor car service, Canadian National, Toronto, Ont. Meetings first Friday of each month except June, July, August and September.

TRAVELING ENGINEER'S ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio. Annual meeting tentatively planned for May 2 to 4, 1935, Hotel Sherman, Chicago.

WESTERN RAILWAY CLUB.—C. L. Emerson, 822 Straus building, Chicago. Regular meetings third Monday in each month except June, July, August and September.

NEWS

THE ILLINOIS CENTRAL has placed on trial in steam train service between Chicago and Urbana, Ill., an all aluminum observation coach built by the Pullman Car & Manufacturing Corporation and displayed at A Century of Progress last year.

P. W. A. Loans to Railroads

THE CHICAGO & NORTH WESTERN has applied to the Public Works Administration for a loan of $5,650,557 for maintenance and equipment work, including heavy repairs to 160 locomotives at an estimated cost of $1,192,500, general overhauling and modernizing of 38 steel coaches, $379,067, installing air conditioning equipment in 6 steel dining cars, 19 steel parlor cars, and 20 steel lounge cars, $358,990, and general maintenance work on roadway, structures and equipment, $3,720,000.

Association of American Railroads Formally Organized

The board of directors of the Association of American Railroads met in New York on October 12 and declared the plan for the formation of the new association, which succeeds the Association of Railway Executives and the American Railway Association, in effect as of that date. Formal written assents to the plan, which is regarded by the railroad executives who formulated the plan as "a concerted effort to protect and advance the railroad industry under private ownership and management to enable them better to handle their own affairs on a permanent basis, as well as to co-operate more effectively with the government in constructively working out a program in the interest of the owners of the railroad properties, their employees, and the public," had been received from 88 railroads or systems, representing 247,048 miles of railroad. An executive committee was elected with J. J. Pelley, president and chairman of the board chairman ex-officio and with the following additional members: Daniel Willard, president, Baltimore & Ohio; F. E. Williamson, president, New York Central; J. J. Bernet, president, Chesapeake & Ohio and Pere Marquette; C. R. Gray, president, Union Pacific, and H. A. Scandrett, president, Chicago, Milwaukee, St. Paul & Pacific.

On the board of directors are: M. W. Clement, vice president, Pennsylvania (succeeding General W. W. Atterbury, president, Pennsylvania); J. J. Bernet, president, Chesapeake & Ohio; L. W. Baldwin, trustee, Missouri Pacific Lines; W. R. Cole, president, Louisville & Nashville; L. A. Downs, president, Illinois Central System; C. R. Gray, president, Union Pacific System; Hale Holden, chairman, Southern Pacific Lines; Fairfax Harrison, president, Southern Railway System; E. S. French, president, Boston & Maine (succeeding J. J. Pelley, president, New York, New Haven & Hartford); H. A. Scandrett, president, Chicago, Milwaukee, St. Paul & Pacific; F. W. Sargent, president, Chicago & North Western System; Daniel Willard, president, Baltimore & Ohio; F. E. Williamson, president, New York Central Lines, and Ralph Budd, president, Chicago, Burlington & Quincy.

The board will meet regularly on the third Friday of each month. The main office will be in Washington and a branch office will be maintained at Chicago but the New York office of the two old associations may be discontinued.

Formation of the new association marks the retirement of Richard H. Aishton, chairman of the Association of Railway Executives and chairman of the board of the American Railway Association, after 15 years of continuous service with the American Railway Association and its predecessor, the American Railroad Association, which took its place during the period of federal control, although it is understood that some plan may be arranged to retain his services in an advisory capacity. Mr. Aishton, who is now 74, had long sought to be relieved of active duty and on April 1, 1933, he tendered his resignation as president of the A. R. A.

New Equipment

CAR ORDERS

Road	No. of cars	Type of car	Builder
Corn products refining Co.	75	8,000-gal. tank	Gen. Amer. Trans. Corp.
U. S. Dept. Interior	2	4-wheel 50-ton flat	American Car & Fdry. Co.

CAR INQUIRIES

Anglo Mexican Petroleum Corp.	12[1]	40-ton flat	.....
Lehigh Navigation Coal Co.	3	Air-dump (30 cu. yd.)	.....
Lehigh Valley	250[3]	50-ft. mill type gondolas	.....
National Rys. of Mexico	1,000	40-ton box	.....

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of locomotive	Builder
Chesapeake & Ohio	3	Pusher (electric)	Atlas Car & Mfg. Co.
C. M. St. P. & P.	2	Streamlined	American Loco. Co.
Nat'l Rys. of Colombia	1	2-8-8-2 oil burner	Baldwin Loco. Works

LOCOMOTIVE INQUIRIES

A. T. & S. F.	1[1]	3,600-hp. Diesel-elec. (Gen. Motors)	.....
C. & I. M.	2[1]	0-8-0	.....
Lehigh Valley	3[3]	Diesel-elec. (600 to 800 hp.)	.....

MISCELLANEOUS ORDERS

Road	No. units	Type of equip.	For use on	Order placed with
A. T. & S. F.	80[2]	Steam eject. air-condition. equip.	.....	Safety Car Htg. & Ltg. Co.
B. & M.[4]	10	Feedwater heaters	locos. under construc.	J. S. Coffin, Jr., Co.
	10	Valve pilots	locos. under construc.	Valve Pilot Corp.
	10	Engine-truck bearings	locos. under construc.	Timken Roller Bearing Co.
B. & O.	8-car	Streamlined train	Bearings and boxes	Timken Roller Bearing Co.
	8-car	Streamlined train	Journal boxes	Hyatt Roller Bearing Co.
C. B. & Q.	2	Streamlined trains	Bearings and boxes	Timken Roller Bearing Co.

[1] Contemplated only.
[2] Thirty railroad owned cars; 50 pullman.
[3] Part of equipment to be purchased with P.W.A. allotment.
[4] Two self-propelled coaches being built for the B. & M. by the St. Louis Car Company will also be mounted on Timken roller bearings and boxes.

but was elected to the new position of chairman of the board, while M. J. Gormley was elected president. He had been chairman of the executive committee of the Association of Railway Executives since 1924. He had become president of the American Railway Association in 1920, after his retirement from active railroad management, as the first to hold that position who was not an officer of an individual railroad. Prior to that time the office of president of the A. R. A. had been held for a year at a time by one of the railroad executives who retained his office on the individual road. In 1929 he also became general chairman of the Presidents' Conference Committee on Federal Valuation.

Dr. Calvin W. Rice Dies

DR. CALVIN WINSOR RICE, for the past 28 years secretary of the American Society of Mechanical Engineers, died in New York on Tuesday, October 2.

Doctor Rice was born in Winchester, Mass., November 4, 1868, and was graduated from Massachusetts Institute of Technology in 1890. In 1926 he was given an honorary doctor's degree in engineering by the Technische Hochschule in Darmstadt, Germany. He was also the recipient of the Knight Cross of the Order of the White Lion from Czechoslovakia, and a medal of honor from the Verein Deutscher Ingenieure. The citation in the latter case included not only his services to technical, scientific achievement, but "particularly in promoting mutual international interests of engineers of the entire world."

His early experience after leaving college was largely in the electrical field. In recent years he was active in the promotion and upbuilding of the New York Museum of Science and Industry, and he also did much to stimulate interest in similar museums elsewhere.

U. P. Second High-Speed Train

THE six-car high-speed train of the Union Pacific which traveled from Los Angeles, Cal., to New York—3,259 miles—in 56 hrs. 55 min. from October 22 to October 25, was built by the Pullman Car & Manufacturing Company. It is the first Pullman-equipped streamlined train to be placed in service in this country.

Aluminum-alloy construction is used throughout in the train, with the exception of the power plant, bolsters and end sills, and steel trucks, and the same general principles of design are followed as in the case of the first U. P. three-car high-speed train. It differs primarily by the inclusion of sleeping cars, Diesel-engine drive and all auxiliary equipment mounted in a single power car; welded high-tensile steel trucks with clasp brakes; Pullman air-conditioning system with Frigidaire cooling units; improvements in certain details of structural design, including the articulated joints; and the provision of double windows, luggage racks and other additional interior equipment. The new train is 376 ft. long and weighs 210 tons, including all equipment, fuel, water, etc., which may be compared with an equivalent conventional train weight of about 700 tons.

The first car of the train, 48 ft. long, is devoted entirely to the power plant and auxiliaries. The second car is 64 ft. long and has 33 ft. for mail purposes, the balance of the car being utilized for a baggage compartment, and for the train-heating and air-conditioning equipment. The third and fourth cars are 64-ft. 24-passenger Pullman sleepers, with 10 sections, one compartment and one bedroom per car. The fifth car, also 64 ft. long, is equipped with 8 sections, one compartment and one bedroom, and has accommodations for 20 passengers. The sixth, or rear-end, car is practically 72 ft. long, being a 56-passenger coach, with a buffet in the rear end for serving light meals to passengers in their seats in the coach and in the Pullman sleepers. The total passenger-carrying capacity of the train is 124.

Power is supplied by a Winton 900-hp., 12-cylinder, two-cycle, V-type, Diesel engine, the first of its type to be used in American railroad passenger service. With 8-in. by 10-in. cylinders, the engine is designed to develop 900 hp. at 750 r.p.m., which may be compared with 600 hp. at 1200 r.p.m. developed by the distillate-burning engine installed on the first U. P. high-speed train. The Diesel engine proper is 20 ft. in overall length and weighs 18,000 lb. The main generator weighs 11,700 lb., and the driving motors 26,400 lb. The weight of the entire power plant, including engine, generator, motors, auxiliary engines, generator sets, pumps, radiators, air compressors, etc., is approximately 79,000 lb.

The power car, fully equipped, weighs 163,040 lb., or 81,800 lb. on the front truck and 81,240 lb. on the second truck.

The air-brake equipment for the train was especially designed and built by the New York Air Brake Company and features the use of the Decelakron control which is designed to assure stopping from exceptionally high speeds within the same or shorter distances than are now common practice with conventional steam trains.

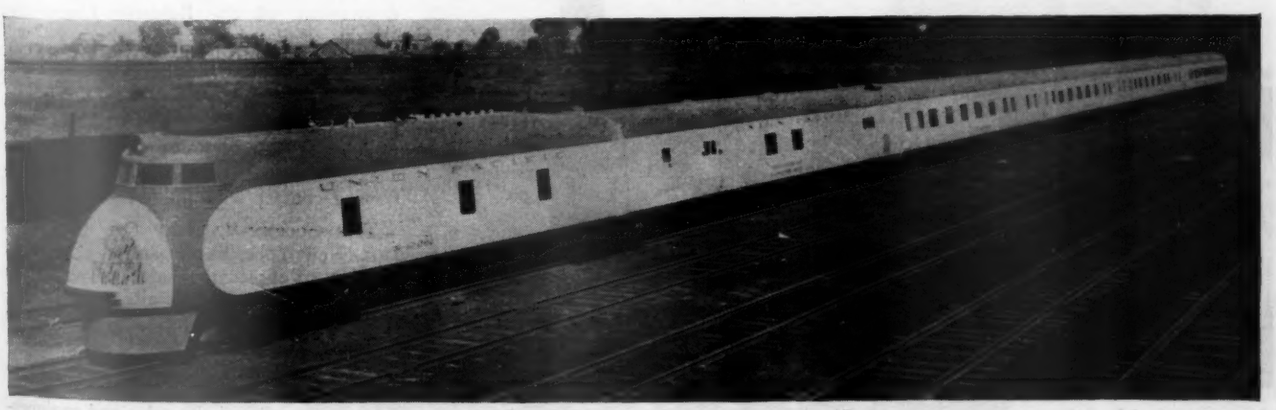
The actual schedule of the train on the trans-continental run, together with the mileages, running time and average speeds, is shown in the accompanying table. The elapsed time from Los Angeles to La Salle street station, Chicago, was 38 hrs. 48 min. and the total elapsed time from Los Angeles to New York 56 hrs. 55 min.

The route of the train was over the Union Pacific from Los Angeles to Omaha, the Chicago & North Western from Omaha to Chicago, and the New York Central from Chicago to New York.

On the entire run the train consumed 2,000 gallons of fuel oil at a total cost for fuel alone of $80. Stops for fuel were at Salt Lake City, Omaha and Chicago.

Trans-continental Schedule of Union Pacific Second High-Speed Train

		Mileage Between stations	Mileage Total	Time		Running time Hr.	Running time Min.	Avg. speed M.P.H.
Oct. 22	Los Angeles	0	0	Lv. 10:00 p.m.,	P.S.T.			
Oct. 23	Salt Lake City	784	784	Ar. 1:35 p.m. Lv. 2:00 p.m.	M.S.T.	14	35	53.6
Oct. 23	Cheyenne	519	1,303	Ar. 10:45 p.m. Lv. 10:55 p.m.	M.S.T.	8	45	59.2
Oct. 24	Omaha	507	1,810	Ar. 6:20 a.m. Lv. 6:30 p.m.	C.S.T.	6	25	79.0
Oct. 24	Chicago (La Salle Street Station)	488	2,298	Ar. 2:48 p.m. Lv. 3:30 p.m.	C.S.T.	8	18	58.6
Oct. 25	New York (Grand Central Ter.)	961	3,259	Ar. 9:55 a.m.,	E.S.T.	17	25	55.0



Union Pacific streamlined train which holds trans-continental speed record

Cincinnati Milling and Grinders Celebrates Fiftieth Anniversary

DURING the week of October 8 to 14 the Cincinnati Milling Machine and Cincinnati Grinders, Inc., threw open the doors of its plants at Oakley, Cincinnati, Ohio, to welcome visitors from the automotive, industrial and railroad fields in celebration of the fiftieth anniversary of the company. Formed in 1884 as the Cincinnati Screw & Tap Company, the original plant was handicapped by the lack of a machine for fluting taps and a small milling machine was designed and built for this purpose. It was not long before neighborhood shops were buying the new Cincinnati miller and in 1889 the company was renamed the Cincinnati Milling Machine Company and henceforth devoted the major part of its efforts to the manufacture of milling machines and cutter grinders. The company's interests were centered primarily in the milling machine field until 1922 when it acquired the Cincinnati Grinding Machine Company and at about that time it brought centerless grinding into prominence.

The exhibit during the anniversary week afforded an opportunity to the many visitors not only to see, at first hand, the numerous and varied operations involved in the development and manufacture of milling and grinding machines and the more recent hydraulic broaching machines, but also to see these machines in actual operation on production work. One of the interesting features of the exhibit was the historical display of milling and grinding machines which gave an opportunity to study closely the progress that has been made in the development of these machines over a period of fifty years. This display enabled the visitor to see, step by step, the major events in the history of the miller—from the first machine with the original tubular section overarm, cone-pulley-driven spindle and hand feeds to the later designs with the universal dividing heads, power traverse and automatic control of table and spindle movements. Later came the introduction of the rectangular section overarm, square-gibbed bearings, power rapid traverse, intermittent feed, feed changes from the front, complete directional control from the front and rear with independent reverse to all table movements, sliding gear mechanisms for drive and feed boxes, and centralized lubrication. Recent years have witnessed the application of anti-friction bearings and enclosed motor drives and finally the Hydromatic and the high-speed, dial type milling machines designed to make possible the full utilization of the advantages of the new cutting alloys.

In the grinding field the exhibits ranged from the early cutter grinders to the more modern centerless grinders introduced in 1922 which development culminated in the new lapping machines which make possible tolerances of .00005 in. in diameter and .000025 in. in straightness and roundness.

In addition to the display of Cincinnati machines there was an exhibit of internal and rotary grinders manufactured by the Heald Machine Co., Worcester, Mass.

A group of old milling machines at the Cincinnati anniversary exhibit—The one at the right is one of the first machines built almost 50 years ago

Supply Trade Notes

LAWRENCE A. ROWE has been appointed special representative of the MacLean-Fogg Lock Nut Company, Chicago, with headquarters at Chicago.

H. A. STEVENSON has been appointed Loadmaster distributor for the Bucyrus-Erie Company, South Milwaukee, Wis., with headquarters at Detroit, Mich.

R. R. LALLY, who has been for several years manager of sales at New York for the Globe Steel Tubes Company, Milwaukee, Wis., has been elected vice-president in charge of eastern sales.

THE EQUIPMENT SPECIALTIES COMPANY, Chicago, has taken over the sale of the Nystrom divided basket bunker for refrigerator cars and the Nystrom rakbrace, a refrigerator car floor rack holder.

WILLIAM E. S. DYER has been elected president of the Edge Moor Iron Company, Edge Moore, Del. Mr. Dyer has been actively engaged in the consulting engineering field for nearly 30 years.

THE HOWARD P. COOK COMPANY, 945 Main street, Bridgeport, Conn., and 140 South Dearborn street, Chicago, has taken over the entire sales to the railroad trade of Jenkins tape, manufactured by Jenkins Bros., Bridgeport.

THE CARBOLOY COMPANY, INC., formerly at 2481 East Grand Boulevard, Detroit, Mich., has moved its general offices, Detroit district office and main manufacturing plant to 2985 East Jefferson Avenue, Detroit.

F. F. SEEBURGER has been appointed western manager for the Railroad Accessories Corporation, New York. Mr. Seeburger has acted as sales representative of the Ohio Brass Company during the past ten years.

THE CARBONDALE MACHINE COMPANY, Carbondale, Pa., has consolidated its interests in the general refrigeration field with those of the Worthington Pump & Machinery Corporation, Harrison, N. J., and will operate in future as the Carbondale Machine Corporation, Harrison.

HAROLD SMITH has been elected vice-president of the Westinghouse Electric International Company. Mr. Smith's new duties are in addition to those of his position as vice-president of the Westinghouse Electric & Manufacturing Company, with headquarters at New York.

W. A. NUGENT, who has been with the Independent Pneumatic Tool Company, Chicago, for 20 years, serving recently as sales manager, has been elected vice-president in charge of sales and Neil C. Hurley, Jr., in charge of the distribution of the company's electric tools, has been elected secretary, both with headquarters at Chicago.

THE TIMKEN ROLLER BEARING COMPANY, Canton, Ohio, was awarded first place for the most effectively conceived and executed industrial advertising campaign of the year in the Tool and Equipment Division of the National Industrial Advertisers Association at the annual convention held in Cincinnati, Ohio, September 18, 19 and 20.

DANIEL B. WORTH, chief engineer of the Whitcomb Locomotive Company, Rochelle, Ill., has joined the engineering department of the Baldwin Locomotive Works, Philadelphia, Pa., where he will be identified with the engineering of Baldwin and Whitcomb electric and internal combustion locomotives. Edward P. Hachtel, Whitcomb production engineer, remains at Rochelle where he will be in charge of inspection and will provide engineering contact with the Whitcomb shops.

THE SOCONY-VACUUM OIL COMPANY, INC., New York, has organized a Railroad division to direct the sales of petroleum products in that field. Railroad sales, under this new arrangement, will be under the general direction of P. M. Gordon, manager, Industrial Lubrication division, who will be assisted by Earle Welborn. In the eastern field the sales and engineer-

(*Continued on next left-hand page*)

Firebox Sheets of
TONCAN IRON
REDUCE MAINTENANCE

"Double the life of ordinary steel firebox sheets" has been the experience of many railroads using Toncan Iron. « « « Because of their superior resistance to chloride, sulphide and oxygenated water corrosion Toncan Iron firebox sheets last longer. « « « Toncan Iron also shows an exceptional ability to absorb breathing strains because of its uniform physical properties gained by a uniform chemical make-up. Less uniform materials must relieve such strains with resulting fire-cracking. Toncan Iron eliminates this local breaking. « « « Toncan Iron has proved its ability to lengthen the life of locomotive fireboxes. Specify it for repairs.

Toncan Iron Boiler Tubes Pipe Plates Culverts Rivets Tender Plates and Firebox Sheets • Sheets and Strip for special railroad purposes • Agathon Alloy Steels for Locomotive Parts • Agathon Engine Bolt Steel • Agathon Iron for pins and bushings • Agathon Staybolt Iron • Climax Steel Staybolts • Upson Bolts and Nuts • Track Material, Maney Guard Rail Assemblies • Enduro Stainless Steel for dining car equipment, for refrigeration cars and for firebox sheets • Agathon Nickel Forging Steel... The Birdsboro Steel Foundry & Machine Company of Birdsboro, Pa. has manufactured and is prepared to supply under license, Toncan Copper Molybdenum Iron castings for locomotives

TONCAN COPPER MO-LYB-DEN-UM IRON

REPUBLIC STEEL
CORPORATION
GENERAL OFFICES YOUNGSTOWN, OHIO

ing organization will be headed by R. R. Vinnedge with office at 26 Broadway, New York City. John E. Ferry, at Chicago, will be in charge of the company's railroad business in the middle and far West.

THE SHIPPERS' CAR LINE CORPORATION, the American Welding Company and the Acme Tank Car Corporation, subsidiaries of the American Car & Foundry Company, at recent special meetings of their respective boards of directors, each elected the following officers: G. R. Scanland, chairman of the executive committee, succeeding William M. Hager, and Robert Rogers, president to succeed R. H. Davenport, both with headquarters at New York.

V. L. CONLEY, assistant district manager of the Cleveland (Ohio) sales district of the American Rolling Mill Company, Middletown, Ohio, has been transferred to the Pittsburgh (Pa.) district as assistant district manager in charge of a new sales office opened in 17 Court Street building, Buffalo, N. Y. This office will have charge of all the territory in New York State from Utica west. A. W. Bryant, with headquarters at Rochester, N. Y., will assist Mr. Conley.

STANTON HERTZ, general sales manager of the Copperweld Steel Company, Glassport, Pa., has been appointed vice-president and chief engineer of that company. Mr. Hertz was graduated from Alabama Polytechnic

Stanton Hertz

Institute in 1911. He served with the Westinghouse Electric & Manufacturing Company for several years and with the Electrical Engineering & Manfacturing Company. During the war Mr. Hertz served overseas as first lieutenant, 56th Engineers regiment. For the past 14 years he has been with the Copperweld Steel Company, starting as electrical engineer, and in 1927 he was appointed general sales manager.

R. J. KNAPP has been appointed representative of the Westinghouse Air Brake Company and the Westinghouse Traction Brake Company, in charge of its Denver, Colo., office, to succeed H. L. Fuller, deceased. Mr. Knapp was for many years employed by the Chicago, Burlington & Quincy successively as locomotive fireman, engineman, fuel supervisor, road foreman of engines and air brake instructor. He entered the employ of the Westinghouse Air Brake Company in 1925, as mechanical expert at Denver. A few months later he was transferred to the Salt Lake City, Utah, office in the same capacity, which position he held at the time of his appointment as representative at Denver. P. L. Bradford has been appointed representative of the Westinghouse Air Brake Company and the Westinghouse Traction Brake Company with headquarters at Boston, Mass., to fill the place left vacant since the death of F. H. Whitney. Mr. Bradford entered the employ of the Westinghouse Company in 1919 as mechanical expert at Boston, which position he held continuously until his appointment as representative at Boston.

A. F. STUEBING has been appointed railroad mechanical engineer of the commercial office of the United States Steel Corporation, with headquarters at 71 Broadway, New York. Mr. Stuebing was born in Lewistown, Me., May 24, 1889, and re-

A. F. Stuebing

ceived his education at Cornell University and the University of Illinois. He entered railway service in 1911 with the Boston & Albany, following which he was with the Pennsylvania, with the Chicago, Rock Island & Pacific and with the Simmons-Boardman Publishing Company, as associate editor of the Railway Age and managing editor of the *Railway Mechanical Engineer*. From 1923 to 1932 he was chief engineer of the Bradford Draft Gear Company and its successor, the Bradford Corporation, and since has been chief engineer of the Par Car Corporation. He is a member of the American Society of Mechanical Engineers and a past chairman of its Railroad Division. Mr. Stuebing has been a frequent contributor to technical periodicals, and has presented numerous papers before engineering societies and railway organizations.

Obituary

JAMES W. RAWLE, vice-president of The J. G. Brill Company, Philadelphia, Pa., died at his home in Lansdowne, Pa., on October 4, after a long illness. Mr. Rawle was born at Williamsport, Pa., on September 6, 1869, where he received his early education. His first employment was with the Bethlehem Steel Company, with which company he was associated for 17 years, having entered their employ in 1889 as a day laborer and working up through the various departments to the position of assistant to the president. In 1906 he entered the employ of The J. G. Brill Company as assistant general manager. In 1914 he was appointed second vice-president and general manager, and in 1926 he was elected vice-president. In addition to being a director of The J. G. Brill Company and its subsidiary companies, Mr. Rawle was a director of The Brill Corporation, the American Car & Foundry Motors Company and The Electric Railway Equipment Securities Corporation. He was actively associated with the Pennsylvania Manufacturers' Association as a member of its executive committee, and was also a director of the association's affiliated companies. During the years 1930 and 1931 he served as president of that association.

JAMES P. ROE, director of research and engineering of the Reading Iron Company, Philadelphia, Pa., died on September 14. Mr. Roe was born on May 19, 1860, at Consett, Wales. At the age of 17 he entered the service of the Consett Iron Company and had been connected with the iron industry since that time. He came to the United States in 1883.

WILLIAM E. MILLHOUSE, president and treasurer of The Burden Iron Company, Troy, N. Y., who died on September 25, at his home in Troy, was born 70 years ago in London, England. Mr. Millhouse came to this country in 1870 and attended the public schools of Troy. In February, 1876, he entered the employ of The Burden Iron Company, and for more than 58 years had been affiliated with the company, having started work at the age of 12 years as

William E. Millhouse

a feeder on one of the swaging machines in its mill, and later working his way up to its presidency. He served in various capacities until 1897, when he was appointed head of the company's wages department. In May, 1907, he was appointed paymaster; two years later he was promoted to assistant secretary and the following year, assistant manager of its mill. On October 22, 1918, Mr. Millhouse was appointed manager of the company, serving in that position until June, 1932, when he was elected executive vice-president and since June of the following year was president of the company. Mr. Millhouse had taken a part in civic affairs, having served as a director of the Troy Chamber of Commerce.

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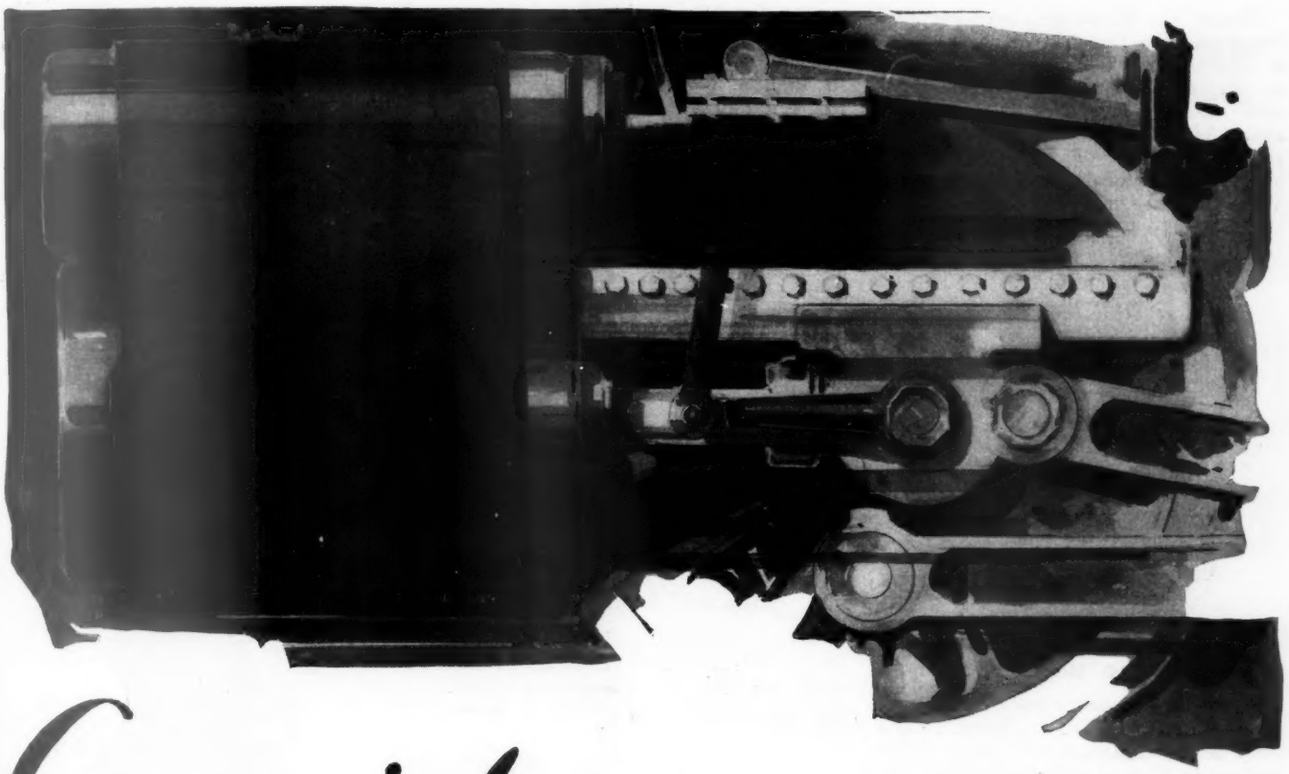


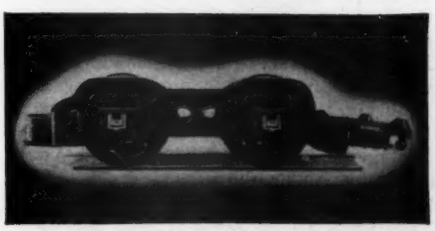
Consider The PISTON THRUST AND ITS EFFECT ON MAINTENANCE COSTS

Obviously the higher the piston thrust the larger the parts must be and the greater the cost for maintenance.

To provide the power needed for starting and for the hard pulls, which may be only 5% of the total time, the main cylinders and related parts must be made larger than are needed for the other 95%—unless the Booster is applied.

Utilization of the Booster permits main cylinders to be proportioned for average conditions over the run; the Booster providing the extra capacity for starting, on grades and for getting in and out of sidings.

Without sacrifice of ton-mile-per-hour capacity, the Booster enables utilization of smaller main cylinders with the resultant lower Piston Thrust and lowered maintenance on both locomotive and track and less capital expenditure.



The close tolerances essential to efficient Booster operation call for genuine repair parts made by Franklin.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO MONTREAL

HIRAM G. HAMMETT, president and founder of the Hammett Machine Works at Troy, N. Y., died at his summer home at Grafton on September 22. Mr. Hammett was born in Auburn, Me., 76 years ago. After graduating from the Massachusetts Institute of Technology he entered the service of the Consolidated Safety Valve Company in Boston as a mechanical

H. G. Hammett

engineer, later becoming assistant electrical engineer of the Boston & Albany. For a while he was engaged in the railway supply business in Chicago and, then, a little over 40 years ago, came to Troy, N. Y., and founded the Hammett Machine Works, manufacturing locomotive specialties and machinery. He served at one time as president of the Chamber of Commerce at Troy, and on the Harbor & Dock Commission and the Troy Port Commission. For many years he was a director of the Union National Bank, becoming a vice-president early in 1933. He was active in the affairs of the Society of Engineers of Eastern New York, serving at one time as its president; also a member of the A. S. M. E.

ALBERT G. ELVIN, inventor of railroad equipment appliances, died on October 10 of a heart ailment at his summer home, Munsey Park, Long Island, N. Y., at the age of 69. Mr. Elvin was born at North Vernon, Ind. He began railway work in 1881, serving as boilermaker and machinist apprentice at Peru, Ind., on the Indianapolis, Peru & Chicago, (now part of the New York, Chicago & St. Louis). In 1889 he entered the service of the Pittsburgh, Cincinnati, Chicago & St. Louis (now part of the Pennsylvania) as a machinist at Indianapolis, Ind., and the following year was put in charge of the tool shop, manufacturing all tools for the entire system. He was later general foreman of the Chesapeake & Ohio at Clifton Forge, Va., master mechanic on the Grand Trunk (now part of the Canadian National) at Montreal, Que., and in January, 1901, was appointed general master mechanic of the Delaware, Lackawanna & Western at Scranton, Pa. During this time he designed and put into operation many labor-saving devices. Among these, in 1896, he introduced the first pneumatically-operated turntables and transfer tables in this country. In 1902 he invented and patented the Elvin driving box lubricator, later known as the Franklin driving box lubricator, which became standard on the majority of locomotives in this country and Canada. In 1903 he became associated with the Franklin Railway Supply Company, then known as the Coffin-Megeath Supply Company, and remained with the company as mechanical manager until 1916, when he retired from active work due to illness. During the time he was with the Franklin Railway Supply Company he invented and patented a pneumatic firedoor and the steam grate shaker. He later invented the Elvin mechanical stoker for steam locomotives. In 1920 he formed in New York the Elvin Mechanical Stoker Company, of which he was vice-president in charge of operation and treasurer. In 1925 he sold his interest in the company and retired from business. Mr. Elvin was well known among railway mechanical engineering men and was a member of the American Society of Mechanical Engineers. He also took an interest in civic affairs, having served as mayor of Plandome, Long Island, and later was mayor at Flower Hill.

Personal Mention

Car Department

WILLIAM LEE, car foreman of the Union Pacific at North Platte, Neb., has been appointed general car foreman, with headquarters at Grand Island, Neb.

Shop and Enginehouse

FRANK BRODBECK, enginehouse foreman of the Union Pacific at Council Bluffs, Iowa, has been appointed general locomotive foreman, with headquarters at Kansas City, Kan.

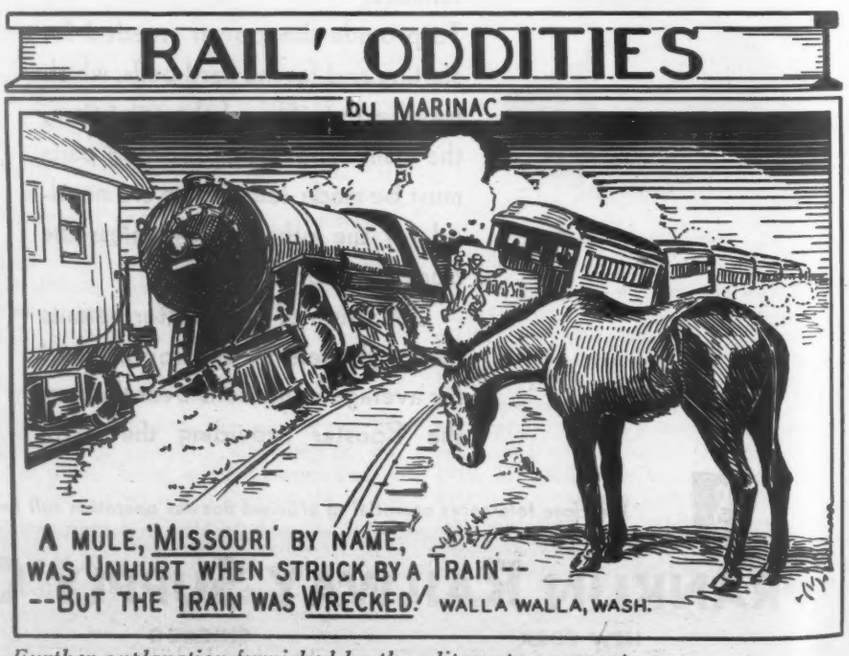
Obituary

JOSEPH HAINEN, former assistant to the vice-president of the mechanical department of the Southern, died on October 17 at Sibley Hospital, Washington, D. C., of blood poisoning after a short illness. Mr. Hainen, who was 69 years old, retired from active service with the Southern in March, 1923.

H. H. HUMMEL, assistant to the general superintendent of motive power of the Southern Pacific, Pacific Lines, with headquarters at San Francisco, Cal., retired on September 1 because of ill health after 44 years of service with this company. The position of assistant to the general superintendent of motive power has been abolished.

H. H. Hummel

Mr. Hummel entered the service of the company in 1890 and served for many years as chief clerk under three general superintendents of motive power. He had been assistant to the general superintendent of motive power since 1927.


RAIL' ODDITIES
by MARINAC
A MULE, 'MISSOURI' BY NAME,
WAS UNHURT WHEN STRUCK BY A TRAIN--
--BUT THE TRAIN WAS WRECKED!
WALLA WALLA, WASH.

Further explanation furnished by the editor upon request